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High Expansion Foam Systems For Aircraft Hangars

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The Global Voice for Passive & Active Fire Protection Systems

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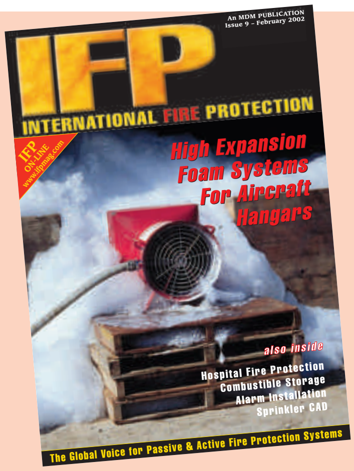

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High Expansion Foam System –
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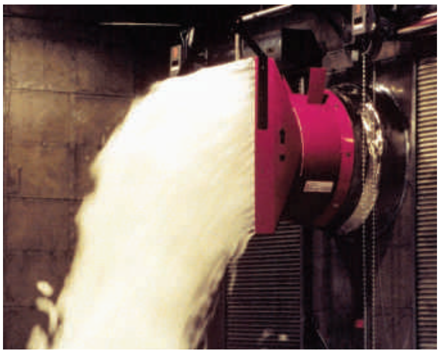

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COMMENT . . .

ISSUE 9, FEBRUARY 2002, another issue full of in-depth technical articles for your enjoyment. We are proud to welcome the **Loss Prevention Certification Board (LPCB)** to our ever-strengthening list of editorial contributors. They will be writing for us in each Issue throughout the year. In this issue, you will find articles from the **NFPA, Fm Global, Warrington Fire Research, Rolf Jenson Associates, ASFP** and many others.

Don't forget, if you want to reference any of the articles featured in the magazine over the last two years, you will find them archived on our website www.ifpmag.com

We are already preparing for our trip to the **NFPA World Safety Conference & Exhibition** in May, where we are always pleased to welcome readers and advertisers on our booth **#1831.** You will find more information on our special show edition on **page 18.**

Kind regards

David Staddon & Mark Seton
Co-Publishers


noveon™
FIRE SPRINKLERS
SAVE LIVES!

Don't Let Your Piping Systems Spring a Leak!

Pic: Copyright © 2002 Factory Mutual Insurance Company. Reprinted with permission. All rights reserved

By FM Global

BACTERIA are simple organisms that rely on nutrients found in their surroundings for their life-sustaining sources of energy. In the right environment, these bacteria can establish themselves on pipe walls or other surfaces where nutrients for their survival are abundant.

One of those environments that are ripe for bacteria is the standard sprinkler system. Why? Because, typically, the water is not recirculated and/or treated in sprinkler systems. And, once certain types of bacteria enter your sprinkler system, they can influence the development of internal corrosion within the piping. This particular form of corrosion, called MIC (microbiologically influenced corrosion) can occur concurrently with other corrosion mechanisms inside the piping and result in, or accelerate, the formation of scale, tubercles and other deposits that may partially or fully block your fire protection system and obstruct sprinkler heads. It also can cause pitting of the pipe walls, creating pinholes in the walls and allowing leaks to form.

WHAT IS CORROSION?

Corrosion is a natural phenomenon that gradually destroys metal by a chemical or electrochemical reaction with its environment. The environment inside the pipe normally contains water, which is conductive. When the water comes in contact with the metal pipe,

It promotes electrochemical reactions between itself and the metal. In steel pipe, these reactions result in the creation of iron oxide or rust.

Corrosion may be relatively uniform over the entire surface or pits may form, sometimes with irregular deposits of corrosion products – tubercles – that may block the flow of water.

In most cases, corrosion inside a sprinkler system is not a major source of property damage and, once detected and diagnosed, can be controlled using relatively simple techniques. However, advanced stages of corrosion can affect several sections of piping, create unacceptable levels of water-damage exposure to equipment and contents or, worse, prevent your sprinkler system from performing when you need it most – during a fire!

IS IT MIC?

MIC is defined as localized corrosion influenced by the activity of different types of aerobic and anaerobic bacteria and other microbes. MIC-causing bacteria can be found in ground and surface waters. They also are found in soils, dust particles, cutting oils and

Don't Let Your Piping Systems Spring a Leak!

HOW CAN YOU TELL IF YOU HAVE SIMPLE CORROSION OR MIC?

Here's how you can tell the difference:

- **MIC is localized and damages pipes through progressive pitting. General corrosion tends to be uniform.**
- **MIC will affect almost all types of metal, including galvanized steel and copper. General corrosion is normally associated with black steel pipe.**
- **MIC creates nodules and slime. General corrosion develops scale within the pipes.**

other substances that can be present in the piping system prior to installation, or that can be carried into the piping system by the local water supply.

Although a widely recognized phenomenon in the oil, nuclear, chemical and sewage industries, MIC's association with fire protection piping is relatively new. In 1995, some facilities insured by commercial and industrial property insurer FM Global in the Phoenix, Ariz., USA, area, were diagnosed with corrosion and leakage due to MIC. As a result, FM Global began looking more closely and systematically at MIC as a contributing factor in cases involving corrosion of sprinkler systems.

In 1997, FM Global scientists and engineers formed a special task group to further study what was known about MIC and its impact on fire protection systems. The task group also reviewed some possible mitigation strategies. This work resulted in the development of a new FM Global Property Loss Prevention Data Sheet addressing internal corrosion of sprinkler systems.

The work of the task group revealed MIC to be a relatively common contributing factor to corrosion in sprinkler systems and, as such, the contribution of MIC should be considered in the context of the overall assessment of a system. The work also revealed that MIC can occur in domestic water systems and that MIC is not confined to any particular geographical area.

It also found that MIC can have damaging effects on both wet- and dry-pipe sprinkler systems. These effects range from the development of pinhole leaks to the growth of nodules that can partially or totally block the waterway. MIC produces biofilm – generally seen as a black slime – which, in certain cases, can be flushed out. Nodules, on the other hand, are hard, well adhered and will not flush out.

While more needs to be studied about this and other types of corrosion in sprinkler systems, as well as the effectiveness of possible mitigation activities, it appears that some simple factors may play a key role in why some systems may be more prone to corrosion problems than others. Some of these factors may include the quality of water, the cleanliness of pipes prior to installation, and the presence of air pockets in wet systems (or water pockets in dry systems).

FM Global has been concerned about the presence of corrosion in sprinkler systems for several reasons. Corrosion can affect how a sprinkler system performs during a fire. Then, there's the potential exposure to losses resulting from sprinkler leakage through pinhole leaks within the piping. This is especially prevalent in water-sensitive areas such as clean rooms, pharmaceutical and food-processing plants, warehouses, and electronics and satellite production facilities. Finally, there's the nuisance and exposure created by constant impairments of sprinkler systems that can result from repeated pinhole leaks.

BE ALERT

You should check for signs of corrosion in your piping system, particularly in your sprinkler system. Telltale signs include pinhole leaks, reduced-flow capacity, nodules, slime deposits and/or even a sulfur-like smell. If leaks are occurring, this may be an indication of advanced corrosion within the system and of the need for an inspection to ensure pipes are not obstructed by scale, tubercles or slime. If leaks represent an exposure or nuisance to an insured's operation, there are ways you can try to stay ahead of leaks, such as having the piping system inspected using nondestructive means, (for example, ultrasonic testing). Also, establish a work plan to minimize shutdowns to reduce the introduction of fresh water, and properly pitch and drain dry-pipe sprinkler systems.

TAKE CORRECTIVE ACTION

If necessary, replace sections of pipe that contain obstructions. Keep in mind, though, that new piping will continue to corrode if the corrosion problems are not addressed. Currently, cleaning the piping system or treating the water is not recommended; however, if you wish to consider these options, there are guidelines in FM Global Data Sheet 2-1, Prevention and Control of Internal Corrosion in Automatic Sprinkler Systems.

To order the data sheet, contact FM Global in the United States at (781) 255-6681.

With more than 167 years of experience, FM Global specializes in commercial and industrial property insurance and loss prevention engineering. Many Fortune 1000, Dow Jones-listed and leading international corporations rely on FM Global to better understand the nature and causes of fire, natural hazards and other risks. FM Global provides them with sound loss prevention solutions that safeguard their properties from loss, provides cost-effective insurance and risk financing solutions, and offers recommendations to minimize business disruption and the financial impact of a loss.

Pic: Fire Suppression Systems Association (FSSA)

HIGH EXPANSION FOAM SYSTEMS FOR AIRCRAFT HANGARS

By Jim Clark
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FOR YEARS foam systems have been used in aircraft hangars for protection of aircraft and facilities in the event of a fuel spill fire. These systems have been primarily a combination of overhead water sprinklers, overhead foam water sprinklers and under wing oscillating monitor systems. The exact total system required for a given hangar has been and is now determined in NFPA 409 and is based on the hangar door height and the fire area.

At first overhead foam water sprinkler system were used, but as aircraft grew in size, the shadow area of the planes became a factor in preventing floor coverage of the foam from the overhead nozzles. Typically aircraft fuel is contained in the wings and fuselage of the aircraft and any fuel leak will be directly under the aircraft. Also the fuel is a contained in large rubber type bladder supported by aluminum structure. Therefore it is of the utmost importance that this area be covered with foam very quickly before there is catastrophic failure of the fuel tanks and all the fuel is spilled onto the floor. Also many operational aircraft use on-board fuel as a heat sink/dissipater. Many hangar maintenance activities, including avionics and hydraulic operations, will cause heating of the fuel on these aircraft thus increasing the volatility of the fuel.

This facilitated the development of using automatic oscillating nozzles for under wing protection. The systems were set off by optical fire detectors and would discharge their stream up under the wings and fuselage of the aircraft thus achieving floor coverage under the aircraft very quickly. For the most part these systems used AFFF foam with its fast spreading ability. The foam was typically applied at 0.10 GPM/Sq.Ft. of area for a total discharge duration of 10 min. The overhead system was either a water sprinkler system or a foam/water sprinkler system depending on the size of the hangar and the requirements of the authority have jurisdiction.

This type system achieved very quick control and extinguishment of the under wing fire area. But the major problem was the systems were susceptible to false trips. The planes being serviced many times had their doors open, allowing AFFF to be discharged into the plane itself! As the world became more environmentally conscious and as EPA standards were implemented it became difficult to deal with a AFFF foam discharge. In many cases a foam/water retention system had to be incorporated into the facility design. Authorities began looking for an alternative type of fire extinguishing agent for under wing fire protection in aircraft hangars.

One such agent was High Expansion foam. High Expansion foam is a foam made up of a mass of uniform bubbles. The bubbles are made with a foam

Pic: courtesy of Chemguard Inc.

solution consisting of water and high expansion foam concentrate liquid. This concentrate is mixed with the water at a ratio of 2% to 3%, meaning that each 100 gal. Of high expansion foam solution will contain just 2 to 3 gallons of high expansion concentrate. This solution is then expanded through a high expansion nozzle or generator at expansion ratios anywhere from 100:1 to 1000:1, the average being approx. 500:1. This means that for every gal. of solution you will be getting 500 gal. of expanded foam. Therefore, in 50,000 gal. of expanded foam, we have 2 gal. of high expansion concentrate. Or, in other words the finished product contains 4 thousandths of 1 percent (0.00004) foam concentrate! This was a far better agent than the AFFF considering the environmental problems.

High expansion foam is a volumetric type of agent rather than a surface type of agent such as AFFF or any type of low expansion foam. High expansion foam fills volumes rather than just covering a surface. When it comes into contact with burning material, the water in the foam solution turns into steam. The surrounding foam helps contain the steam, and because the oxygen percentage in the expanded steam/air mixture is reduced, it results in a smothering effect. The conversion of water to steam also cools through absorbing heat and lowering the temperature of the material.

This foam could be applied in a thick blanket to cover the floor area of the hangar without being so high as to be able to enter aircraft doors. Even in the event that some agent did get into the aircraft, tests conducted by the Massachusetts Institute of Technology conclude that high expansion foam can be used in electronic equipment with little or no damage to the equipment from the foam. If the foam is allowed to dissipate, a very minute residue will be found which can easily be swept or vacuumed up. High expansion foam is very light and bulky resulting in a foam that does not travel very fast, and obstacles in the hazard area can be a determent to the foam travel. Foam spread over a liquid surface proceeds at a rate, which approaches 3 feet per second. The rate decreases as the circumference of the spreading mass increases. Over dry surfaces spread starts out at a rate of 2 feet per second but slows down fairly rapidly. This is due to the loss of wave effect of the impacting foam and the increase circumference of the foam mass but also to surface drag. Tests have shown that at a discharge rate of 6000 CFM the high expansion foam will reach a spread diameter of 100 feet in less than 4 minutes. Therefore the placement and the number of high expansion generators would be critical in achieving floor coverage in a timely manner. It is necessary that low-level high expansion generators be located so that foam discharge falls close to, but not directly on, aircraft fuselage or wings. Initial discharge of foam must protect the under wing and under aircraft area and then spread to the remaining hangar floor area. Low-level high expansion generators may be designed to use either outside or inside air, but it is preferred that they use outside air when possible. It was determined that a coverage time of a foam blanket three feet thick of one minute would provide adequate protection. Aircraft hangars present several factors that are critical to the performance of a high expansion foam system. One such factor is that it is very important that every effort be made to insure the hangar doors are always in a closed position when fueled aircraft are in the hangar.

Aircraft high expansion foam systems should be designed in accordance with NFPA 11A. This standard gives the formula for calculating the minimum rate of discharge or total generator capacity as follows:

High expansion foam fills volumes rather than just covering a surface. When it comes into contact with burning material, the water in the foam solution turns into steam. The surrounding foam helps contain the steam, and because the oxygen percentage in the expanded steam/air mixture is reduced, it results in a smothering effect.

$R = ([V/T] + Rs)\ Cn \times Cl$

Where:

R = Rate of discharge in Cu.M/min (cu.ft./min)

V = Submergence volume in Cu.M (cu.ft.) determined by the following formula: **$V = A \times D$**

Where:

A = Area of the aircraft servicing floor and adjacent floor areas not cut off from the service floor Cu.M (sq.ft.)

D = depth = 1 meter (3.28 feet)

T = Submergence time in minutes = 1

Rs = Rate of foam breakdown by sprinklers in cu.ft./min determined by the following formula: **$Rs = S \times Q$**

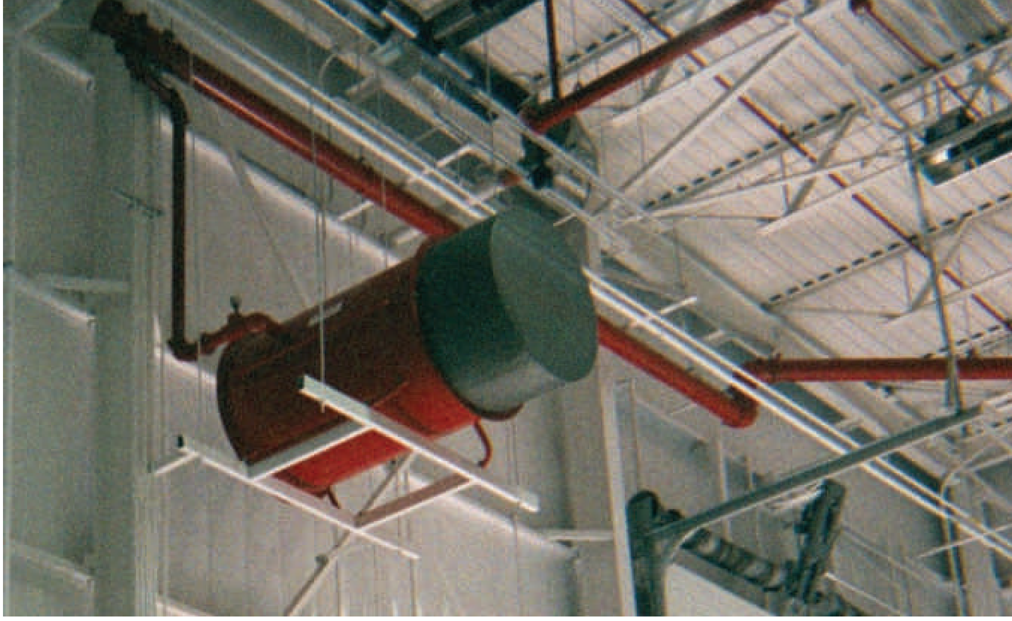
Where:

S = Foam breakdown from sprinkler discharge = 0.0748 Cu.M per minute x L/min. (10 cu.ft./min x gpm) with the exception of Chemguard generators which U.L. allows a factor of 6.4 cu.ft./GPM breakdown due to Chemguards more stable foam.

Q = Estimated total discharge from maximum number of sprinklers expected to operate in L/min.

Cn = Compensation for normal foam shrinkage = 1.15 This is an empirical factor based on average reduction in foam quantity from solution drainage, fire exposure, wetting of surfaces, and absorbency of stock.

Cl = Compensation for loss of foam due to leakage around doors and windows and through unclosed openings determined by the design engineer after proper evaluation of the structure. This factor can be as low as 1.10 to as high as 3.0 (the factor required by the U.S. Air Force)



Pic: courtesy of Chemguard Inc.

Pic: Fire Suppression Systems Association (FSSA)

The use of these factors will result in the total generator output required to cover the hangar, then a decision should be made taking the factors mentioned before concerning the placement of generators in achieving the stated goals of coverage. When all this is taken into consideration the number of generators can be determined.

These systems still use a detection system using optical fire detectors with manual pull stations located through out the hangar.

The high expansion foam proportioning system can be either a balanced pressure pump type system or a bladder tank type system. In either case there has to be enough high expansion foam concentrate stored in the tank for continuous operation of the system at the required discharge rate for a period of at least 12 min. A connected reserve concentrate tank does not have to be provided. The foam proportioning system including the concentrate storage tank should be located in a dedicated fire protection equipment room isolated from the aircraft servicing area by construction rated for at least one hour.

These systems still use a detection system using optical fire detectors with manual pull stations located through out the hangar.

High expansion foam is a very versatile agent, which is biodegradable, low in toxicity, and can be treated in sewage plants and U.L. listed. As in all modern fire protection systems it is important to be sure the equipment and foam liquids are U.L. listed.

FSSA news

FSSA Celebrates 20 Years

The Fire Suppression Systems Association celebrated its 20th anniversary in February at its annual meeting in Marco Island, Fla. The association was founded in 1982 with three principal goals:

- Provide a voice for manufacturers and installers of special hazards systems in the fire protection arena.
- Gain acceptance of special hazards systems as a viable form of fire protection.
- Educate fire protection decision makers about the benefits of special hazards systems.

SHAPE is FSSA's effort to educate those who make and influence the fire protection decision about the features and benefits of special hazards systems.

"We have a lot to celebrate," said FSSA President Paul Harris. "By joining forces, our members now have the voice that was missing in 1982. Our products are now widely recognized as a viable form of fire protection and the fact that someone is reading this article is tribute to our communications program."

To provide its members a voice, FSSA maintains representation on 27 National Fire Protection Association technical committees responsible for writing the standards applicable to FSSA members' products. FSSA also has a voice in ISO standards and other regulating processes.

To gain acceptance and educate decision makers about member products, FSSA created its SHAPE program. Short for Special Hazards Awareness, Promotion and Education, SHAPE is FSSA's effort to educate those who make and influence the fire protection decision about the features and benefits of special hazards systems. As part of this program, FSSA representatives make regular presentations of industry and end-user meetings and deliver information to the media as well.

To move forward, FSSA leaders undertook a strategic planning session at the Florida meeting. A report of that meeting and the resulting FSSA programs will be announced shortly.

Clean Agent Training Videos

FSSA is now selling a four-tape video training series on clean agent suppression systems. The tapes, produced by Protection Knowledge Concepts, Inc., are designed for anyone who designs, specifies, inspects, buys, approves or maintains clean agent systems.

Unit one covers the basics of special hazards fire suppression. It includes information on general building versus special hazards fire protection and answers some basic questions about clean agent systems. What are they? Why are they used? Where are they used?

This series is a must for anyone involved with clean agent systems.

The second tape addresses standards and regulations. It covers Halon issues, NFPA standards for clean agents, the EPA SNAP list, NOAEL and LOAEL and alternative clean agents.

The third tape covers alternative agents to Halon 1301. It addresses carbon dioxide, INERGEN, FM-200 and FE-13 systems.

The fourth tape covers maintenance and training issues. It addresses fire detection and alarm systems, basic maintenance of clean agent systems and personnel training.

This series is a must for anyone involved with clean agent systems.

Pipe Design Handbook

FSSA's Technical Committee has published the group's *Pipe Design Handbook for Use with Special Hazards Fire Suppression Systems.* The handbook features new design guidelines for use with all types of engineered special hazards systems where the Power Piping Code is specified.

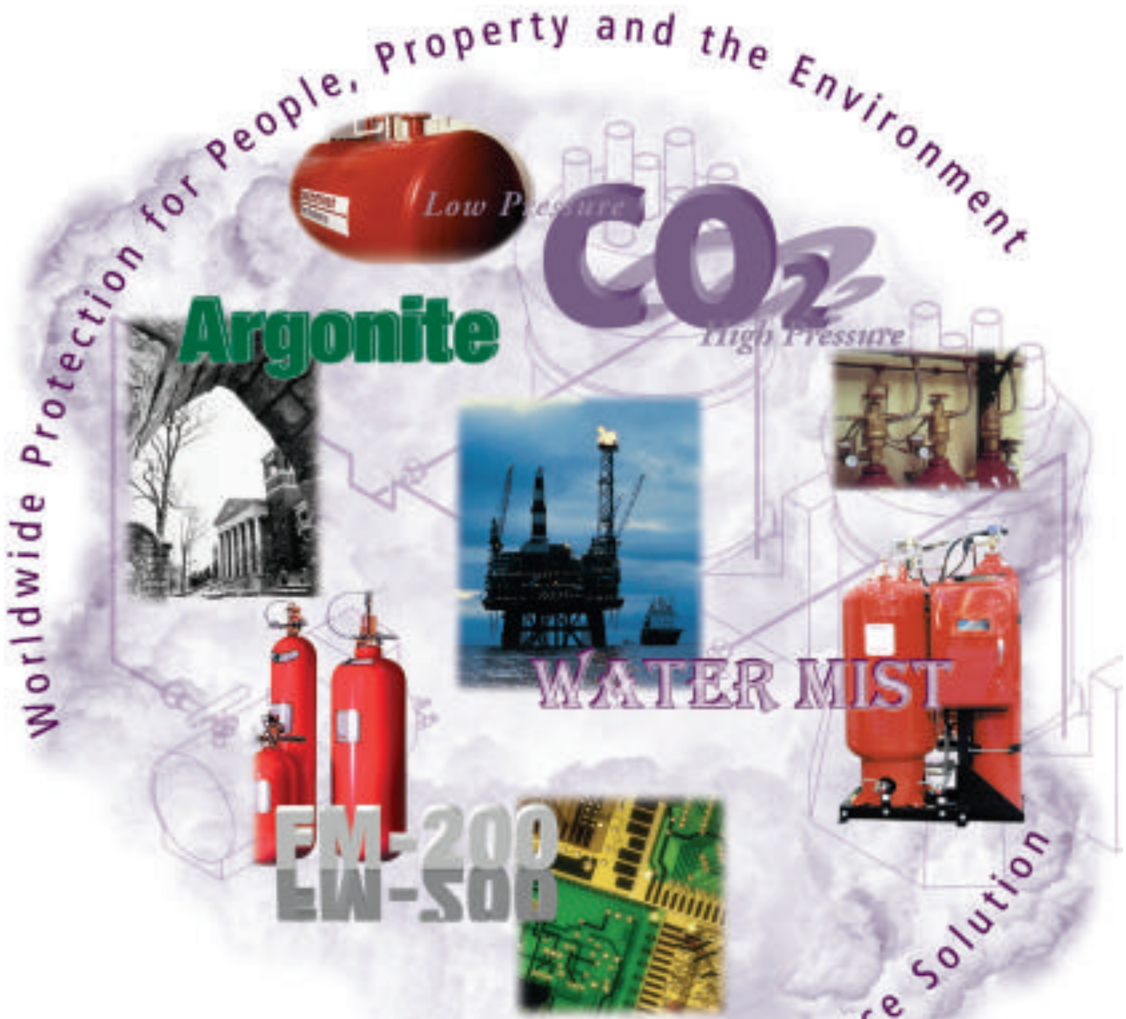
"This is the most comprehensive piping handbook in the industry for use with special hazards fire suppression systems," says FSSA Technical Director Charles Willms, P.E. "It provides guidance for conditions not specified in NFPA standards."

The handbook is currently available at www.fssa.net. The cost is $75 for FSSA members and $175 for non-members.

Web Site Enhancements

FSSA continues to update its web site with useful information on special hazards fire suppression systems. Visitors to www.fssa.net should review the technical library as well as the industry forum. The library houses several helpful documents and the forum allows for questions to be posted and answered by industry experts.

CHEMETRON Fire Systems™



Chemetron Fire Systems is the world's single source solution for start-to-finish special hazard protection technology, control, and support. Integrating hardware, agent and technical expertise results in a more targeted and effective fire suppression for a wide range of global applications.

Chemetron offers over sixty years of commitment to fire safety with proven advantages that better serve your ever-changing business environment specifications with:

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Chemetron Integrated Fire Suppression Systems is the extra measure of safety for your business.

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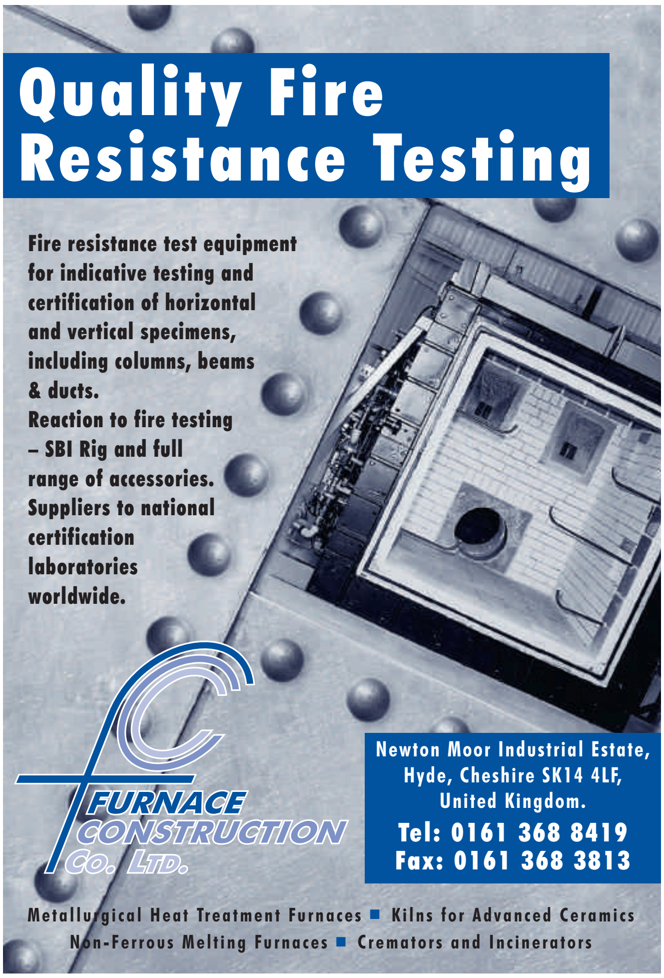

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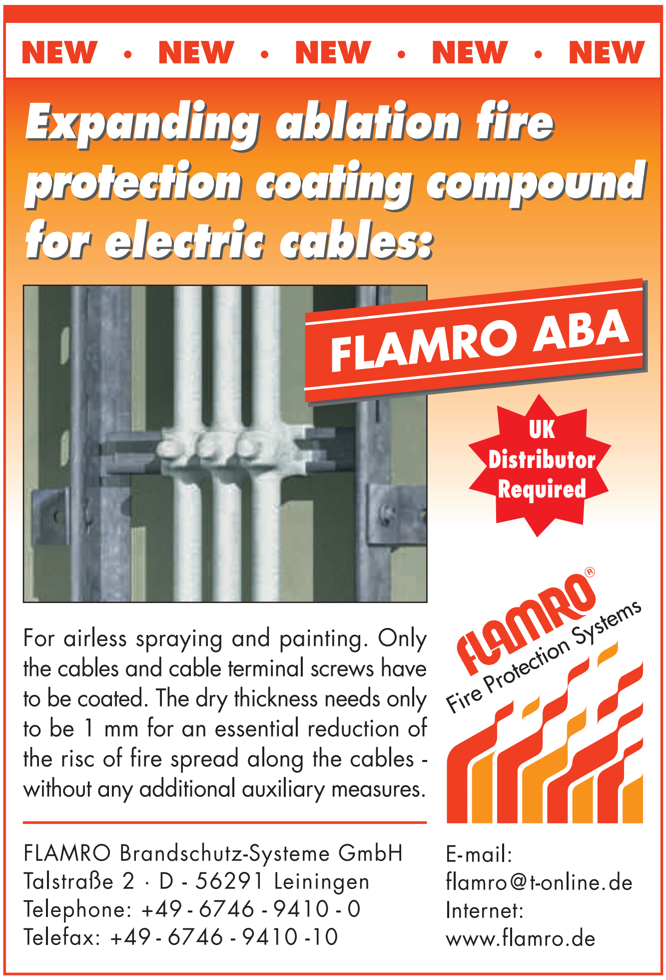

Enquiries: flamro@t-online.de

By LPCB

PASSIVE FIRE PROTECTION

Pic: courtesy of LPCB

A fundamental issue of the fire protection of buildings is the correct specification of fire-resistant products and systems

How do you know you are specifying a good fire protection product?

The most effective way would be to choose an approved product. Approval is independent third party confirmation that products, systems, services and personnel meet and continue to meet the standard or specification.

Wouldn't a tested product do?

A test is basically a snapshot showing that the product passed the test on a particular day. A test may also only be ad-hoc or indicative where a published standard does not exist for the particular product type. Third party approval obviously comprises testing, but rigorous factory process audits are also undertaken on a rolling programme and this provides an audit trail which ensures that the product on sale in the market place is still to the same specification as was originally tested.

Is specifying a good fire protection product enough?

It is a well known fact that even if you have chosen a good passive fire protection measure, this product could be severely compromised by poor installation or application and this factor could lead to its failure in a fire scenario. Unlike a decorative finish or even a smoke detector, which is normally obviously visible, poor passive fire protection isn't apparent until there is a fire.

The Loss Prevention Certification Board (LPCB) has developed a standard for the approval of installers entitled LPS 1231 *Requirements for the Certification of firms installing or applying passive fire protection products.* The specification for correct installation of the product is laid down by the manufacturer. LPCB approves this specification and also monitors the training courses offered to the installer. At this point a good relationship develops between the manufacturer of the fire product or system and the installer.

Manufacturers must train the installer in the correct installation of the product and also ensure that he has a good understanding as to the scope of application for the product. Although the installer has received training, it doesn't necessarily mean that he knows everything about the product. He may encounter problems on site where for instance the contractor may propose that the product with a fire resistance of 30 minutes be installed in a wall with a higher fire resistance of say 2 hours. This would severely compromise the fire protection of the wall. This is when the unique relationship is crucial as the installer consults the manufacturer and together they will come up with a quick solution to the problem.

How is LPCB approval maintained?

As stated earlier, LPCB approval comprises regular auditing of the factory process control. In the case of a

Pic: courtesy of Bolton Brady Konematic Ltd

company approved to LPS 1231, LPCB would be looking mainly at the installed product. Factory process control is usually tied in with ISO 9000 which is an effective tool in the audit trail, looking at the Quality Management System of the installer, the company's structure, its financial stability, its training courses, sales literature, even down to the point of checking how complaints are handled. Used alongside an approval scheme such as LPS 1231, ISO 9000 demonstrates that the risks are beings assessed correctly.

Who benefits from approval?

Well, we all do! The main contractor will be happy to use the product and the installer again and again as the job was carried out in a professional manner, within the time-scale, without any rework. The designer or client will be happy with the main contractor as the work was completed against the specification and on time. The fire service will be happy that all the regulations have been adhered to. The insurer will be happy as he can see that risks have been identified and addressed by the specification of approved products and installed by an approved company. The building owner can demonstrate all due care and diligence. And last but not least, the building occupier is inherently safer!!

Of course approval also benefits the approved company or they wouldn't apply for it. Independent third party approval demonstrates that the product or service does what it is intended to do. By obtaining an objective assessment by a knowledgeable and well-established certification body such as LPCB, be it of a product system or service, this in itself helps manage risks. Approval helps provide compliance with regulations and legislation and gives the approved company a marketing edge over those that do not have certification and perhaps only hold a test report.

Specifiers such as consultants, architects, designers and contractors can be sure that by specifying approved products and installers they are reducing the risk and that they are obtaining the best fire protection available.

In summary, approval of passive fire protection products and installers offers the following benefits:

- Keeps the cowboy out
- Gives confidence to clients, contractors, insurers and specifiers
- Helps to ensure that the correct product has been specified and correctly installed
- Promotes good practice and partnering

For a complete listing of approved products, systems and installers please visit our website at www.redbooklive.com or telephone 01923 664100.

LPCB PASSIVE PRODUCT CERTIFICATION SCHEMES

The LPCB operates a large number of product certification schemes within the passive fire industry. Current schemes include:

LPS 1056: *Requirements and tests for fire doors, lift landing doors and shutters*

LPS 1107: *Requirements, tests and methods of assessment of passive fire protection systems for structural steelwork*

LPS 1124: *Requirements, tests and methods of assessment for LPCB certification of active fire protection systems (intumescent) for structural steelwork*

LPS 1132: *Requirements and tests for wall and floor penetration and linear gap seals*

LPS 1158: *Requirements and tests for fire resistant glazing systems*

LPS 1162: *Requirements and tests for fire dampers*

LPS 1181: *Requirements and tests for wall and ceiling lining products and composite cladding products*

LPS 1182: *Requirements and tests for fixed fabric smoke curtains, fixed metal smoke curtains and powered smoke curtains*

LPS 1195: *Specification for testing of temporary buildings for use on construction sites*

LPS 1197: *Requirements for firms undertaking the maintenance and repair of doors, shutters, smoke barriers & smoke/fire barriers*

LPS 1207: *Fire requirements for protective covering materials*

LPS 1208: *Fire resistance requirements for elements of construction used to provide compartmentation*

LPS 1215: *Flammability requirements & tests for scaffold cladding materials*

RADAR Results

by Niall T Rowan
European Co-ordination and Development Manager

Pic: Warrington Fire Research Centre

RADAR projects and the European Supplement to AD-B

RADAR is an acronym for **R**esearch on **A**pproved **D**ocument **A**nd **R**evision, a research project initiated under the governments Partners in Innovation Scheme, with the aim of providing the DTLR (formerly DETR) with information on which to base a revision to AD-B. Niall Rowan of Warrington Fire Research discusses the project and its implications for manufacturers of passive fire protection materials.

Introduction

A key aim of the European Union is the removal of barriers to trade between member states. Presently a manufacturer wishing to sell their product into Europe has to meet the national fire test requirement for every market in which he/she wishes to operate. As requirements vary from one country to the next, this constitutes a barrier to trade, which, in the construction sector the EU is aiming to overcome through the implementation of the Construction Products Directive (CPD).

In support of the CPD some 600 European Technical Specifications for construction products are being prepared. These, in turn, require approximately 1500 supporting standards, which include fire test methods. It is estimated that around 80% of construction products have a stated fire performance and consequently, the development of European test and classification methods is a vital aspect of the new European system.

The need to revise AD-B

Each Member State is obliged to adapt their national regulations to allow the use of new European fire test methods to satisfy their requirements. For England and Wales, the relevant document is Approved Document B (Fire), which is published by the Department of Transport, Local Government and the Regions (DTLR, formally DETR). Under the current arrangements, manufacturers are obliged to use the existing British Standards (BS) which means that they will have to test their products again to the European Standards (EN) when CE becomes mandatory across most of Europe. However, the publication of a supplement to AD-B will allow manufacturers to test the new ENs now to satisfy the current requirements as detailed in AD-B. The benefit of this for manufacturers is that they only need to test once, providing that the test is to the appropriate new EN.

To make it possible for the DETR to produce the supplement, they needed to know if product performance changed when tested against the EN standards as opposed to the BS standards. If products performed less well, the consequence may have been that a currently satisfactory product suddenly became unsatisfactory and was outlawed, with no justification in terms of fire safety. For example if a product achieved 30 minutes fire resistance under the British Standard and was acceptable for use in accordance with AD-B, it may have achieved 25 minutes under EN test procedures and become unacceptable. The product and the Building Regulation requirement remained the same, but the new test standard changed an acceptable result into an unacceptable result, with no justification in terms of fire safety in buildings.

Pic: Warrington Fire Research Centre

Partners in Innovation

In order to give the DETR the information they required, two research projects were commissioned under the department's Partners in Innovation scheme. This scheme allows organisations (partners) to apply for government funding for projects, which are considered to be of mutual benefit to both partners. The DETR will provide up to 50% of the cost of the project, the remainder being raised by the other partner(s). The two projects commissioned by DETR were run by WFRC with DETR providing half the funding, individual companies (manufacturers) providing the remainder. RADAR 1 dealt with fire resistance issues and RADAR 2 dealt with reaction to fire issues.

RADAR Objectives

There were two primary objectives. The first was to gain information about changes in performance for range of products when tested 'back to back' against BS and EN standards. That is, identical specimen were tested on consecutive days to the BS and then EN standards, with any changes in performance from one to the other being noted. The second objective was to collate and analyze the data for the preparation of a report for DETR, which would make recommendations regarding the performance requirements to be specified in the supplement to AD-B.

For fire resistance, as the test method was fundamentally unchanged for most products, only the time periods needed to be changed to reflect the different levels of performance (i.e. raised or lowered according to the results obtained). However, in the area of reaction to fire there were new test methods, requiring a more in-depth analysis to determine if any equivalence could be drawn between the UK classes and the European ones.

Who was involved?

The projects were managed under a committee structure, chaired by Warrington Fire Research Centre (WFRC) as the lead partner. Other members included the DETR, the Scottish Executive and representatives of the industry partners participating in the project. Various groups had the task of selecting samples, managing the project for their sector and making recommendations regarding the performance of products within their industry sector.

Product selection

RADAR 1 had six product sectors: doors, walls, glass, ceilings/floors, dampers, and steel.

RADAR 2 had seven product sectors: wood, mineral wool, paints, wall coverings, board and sheet material, plastic sheet, and cellular plastics. When selecting products for each sector, the following factors were taken into consideration:

- Aim to cover the complete range of materials and constructions as far as possible
- Aim to cover the full range of fire resistance periods and reaction to fire classes as far as possible
- Use 'real' products that were currently available and acceptable (not development/new products)
- Product selection should favour those that were considered most likely to be affected by new test methods

'Back to back' testing

Early in the project it was agreed that to make a true comparison between the BS and EN methods, products would be needed to be tested to both test methods rather than relying on historic (existing) test data for the BS tests. By 'proving' the existing performance under the BS, any change in performance could only

Pic: Warrington Fire Research Centre

Pic: Warrington Fire Research Centre

be attributed to the EN test method. This approach was vindicated during the project as several materials and constructions failed to achieve their 'historic' class under the BS test while achieving a similar or slightly lower performance under the EN. If no BS tests had been carried out, the perceived large degradation of performance would have been erroneously attributed to the EN method alone.

Results

To include a detailed discussion on the results of the individual tests is beyond the scope of this article. In RADAR 1, 22 products were tested and in RADAR 2, 64 products were tested with both projects also using significant amounts of additional data from other sources. Full reports of both projects can be downloaded free of charge from the WFRC Website at: www.wfrc.co.uk. However, some important trends can be included here.

RADAR 1 RESULTS

The results of the tests indicated that the EN tests were more severe (2 – 20%) with a typical reduction of approximately 10% in fire resistance performance time. This meant that many products were 'downgraded' a class e.g. a product that achieved 32 minutes fire resistance under the BS test would be classified as having 30 minutes fire resistance, but if it only achieved 28 minutes under the EN it would be classified as only having a 20 minute performance.

RADAR 2 RESULTS

The results of the tests indicated that there was a good correlation of results between the most regulated classes i.e. UK class 0/1 and Euro class B/C respectively. Thirty-one products corresponded between UK class 0 and Euro class B and ten products corresponded between UK class 1 and Euro class C. There seemed also to be a good correlation between other UK classes and their European equivalents, although there was less data available to support this as the majority of manufacturers aim for class 1/0. The lower classes 2-4 are of limited interest the majority of UK manufacturers.

Conclusions

Given the different natures of the products and test methods considered under each project, no single conclusion could be drawn across the board. For RADAR 1 the conclusions were mainly concerning time periods, while for RADAR 2 the conclusions addressed the equivalence of UK classes with European classes determined by fundamentally different tests. A summary of the conclusions reached for each project is given below.

RADAR 1 CONCLUSIONS

- The EN tests are more severe and consequently many products would drop a class
- In most cases lowering regulatory requirements would lead to more market distortion i.e. the product would be significantly more over engineered to the new class than under engineered to the existing class
- Experience shows that lowering classes leads to downgraded products
- Lessening the impact on the market was best served by retaining existing classifications
- Industry and the regulators accepted this because they could achieve it at relatively little cost
- It was concluded to retain the existing fire resistance periods
- There was a need to address provisions for unprotected structural steel

RADAR 2 CONCLUSIONS

- A good transposition could be made for most products between their UK and European classes
- In most cases DETR could effectively substitute the required current UK class with the corresponding Euro class – see table below
- There were some products, which did not fit the trend due to the new EN test, or the way in which the products had previously behaved in the BS test
- Further research needed on difficult to test products and mounting and fixing systems

UK Class	Euro class
Non-combustible	A1
Limited combustibility	A2
0	B
1	C
3	D
4	E
Unclassifiable	F

The European Supplement to AD-B

As a result of the RADAR projects the DETR has produced a draft European Supplement to the current AD-B, which includes the ability to satisfy its provisions by using the new European tests. The supplement, incorporating all of the recommendations and conclusion that resulted form the RADAR projects, is out for consultation and is expected to be published during 2002. For more information with a link direct to the DTLR's page on the European Supplement, visit the WFRC website at **www.wfrc.co.uk.**

Reliable Storage Sprinklers:

One Size Doesn't Fit All

As we have learned from fire testing on new products and by researching fire losses in storage applications, we now know that the usage of standard $^{1}/_{2}$″ (15mm) and large orifice sprinklers $^{5}/_{8}$″ (20 mm) will be limited in the future. They will be limited because larger orifice sprinklers can provide better protection while also providing cost savings. More water from the initial operating sprinklers and quick response time are the keys to good storage protection.

NFPA 13 requires that for storage applications, with densities exceeding .34 gpm/ft^2 (13.9 mm/min), sprinklers with nominal K factors of 11.2 (160) or larger that are listed for storage application shall be used. There are also special application listings for these larger orifice sprinklers that permit reduced design areas for storage of cartoned class IV commodities and containing group A and B plastics with heights to 20 feet (6.1 m) high and building heights to 27 feet (8.2 m).

Reliable's G-XLO, K=11.2 (160) and G-VELO, K=14.0 (200) are approved with these special application listings that allow the design area to be reduced from 4000 square feet (372m^2) to 2000 square feet (186 m^2). This will cut in half the water demand for the system. The larger K factors will also provide the required densities at a lower starting pressure. This offers the potential for reduced pipe sizes and the possible elimination of fire pumps and other water supply supplements.

For ESFR protection, the K-14 (200) ESFR can provide good protection for buildings up to 40 feet (12.2 m) in height and with storage that does not exceed 35 feet (11.0 m) in height. However, the K-14 (200) ESFR requires a very high operating pressure. The K-14 (200) ESFR now also requires one row of in-rack sprinklers for 45 feet (13.7 m) high buildings with rack heights of 35 feet (11.0m) and 40 feet (12.2 m).

Reliable's new K-22 (320) ESFR provides excellent protection for all building heights up to 45 feet (13.7 m) high and with storage up to 40 feet (12.2 m) without in-rack sprinklers. The larger K factor uses a lower starting pressure and can help to reduce pipe sizes and eliminate fire pumps.

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Beam me up, SAFELY

The features and applications of beam smoke detectors are Examined by Richard Brown of Fire Fighting Enterprises Limited

Introduction

Optical beam smoke detectors account for a relatively small number of the commercial grade fire detectors sold across the world. Most fire protection systems use compact "point" (or "spot") detectors, and these are well suited to the enclosed rooms, hallways and staircases, which make up the majority of commercial premises. However, where fire protection is required for large open areas, beam detectors have established themselves as a more economical alternative. Moreover, in certain circumstances they can actually be more effective than point devices.

PRINCIPLE OF OPERATION

At its simplest, a beam detector consists of a light source, typically an infrared LED, directed towards a photoelectric sensor. The output current of the sensor varies in proportion to the intensity of light falling on it. Enclosed in suitable housings with adjustable mountings to allow precise alignment, the light source (or transmitter) and sensor (receiver) are installed on opposite walls a short distance below ceiling level. Smoke particles present in the air will obscure the light beam to some degree, causing a measurable drop in current, which can be used to trigger an alarm.

It is important to distinguish this, the *obscuration* principle of detection, from the way in which optical point detectors measure smoke. Although the self-contained point detector comprises the same basic elements of light source and sensor; here the sensor is configured at an angle of up to 90 degrees to the source, not opposite. This arrangement measures not the obscuration of light by smoke particles but its *scattering*; more smoke in the measurement chamber means more light is scattered in the direction of the sensor. For this reason, the large-scale beam detector is sometimes called a linear detector to distinguish it from the point detector with its non-linear light path.

With products such as Fire Fighting Enterprise's FireRay 2000, electronic controls are not housed in the detector modules but removed to a wall-mounted control unit for greater accessibility.

COST SAVINGS THROUGH WIDE AREA COVERAGE

Beam detectors are by nature suited to the protection of wide areas. They can be used in most buildings containing open spaces and high ceilings, with typical applications including hotel atria, shopping malls, churches, warehouses and sports halls. While specifications vary from one manufacturer to another, the maximum distance that can be covered by a single beam detector (that is, one transmitter and one receiver) is generally around 100 m. At this distance, the area protected can be 1500 m^2 or more. To cover the same area with point detectors – assuming that the ceiling is not so high as to make their use inappropriate – would require perhaps fifteen devices.

This will almost certainly mean a cost saving in terms of detector hardware, as the purchase price of a beam detector is comparable on average to

Beam me up, SAFELY

that of ten point detectors. However, with cabling needed for just two devices instead of fifteen, the savings in terms of installation time and cost can be even more significant. In addition, the process of commissioning a new detection system becomes simpler because there are fewer devices to test.

Once installed, beam detectors continue to represent good value because with fewer detectors in a given area, maintenance and servicing will be easier and quicker. This is especially true where ceiling level can only be reached with the aid of hydraulic platforms or scaffolding towers; clearly, as this sort of equipment is disruptive as well as costly, most commercial premises will want to keep its use to a minimum.

The wall-mounted position of beam detectors – in contrast with point detectors, which must be positioned away from the walls – can also help to make access easier. In a warehouse, for example, where stored goods and plant at floor level may make it difficult to position climbing or lifting gear beneath point detectors, the peripheral location of a beam detector can usually be reached without difficulty using a ladder.

Established two-head technology is now complemented by detectors, which combine the transmitter and receiver in a single module, such as FFE's FireRay Reflective. In some types of building these products can cut installation costs by halving the number of devices requiring cabling.

KEEPING A LOW PROFILE

Beam smoke detectors are not the sole preserve of warehouses and other commercial premises where low installation and maintenance costs make them attractive to specifiers. In historical churches, stately homes, castles and similar large-roomed "heritage" buildings, mounting a small number of devices on the walls is preferable to laying extensive cabling behind a fragile, intricately detailed ceiling. Indeed, in cases of particular architectural significance it may be essential.

Of course, a number of manufacturers produce point-type fire detectors, which communicate with control equipment using radio signals in order to minimise cabling requirements in buildings of this sort. However, these may not be suitable for every project. Not only are they apt to be expensive when compared with beam detectors; they must also be installed in the same high numbers as any other point devices, and may

In historic buildings with intricate ceiling decoration, a wall-mounted beam detector may be preferable to several ceiling-mounted point detectors.

as a result be more visually intrusive than beam detectors. Clearly, as long as the highest standards of life and property protection can be maintained, historical buildings should have on display as few modern-looking devices as possible.

TECHNICAL REFINEMENTS

As with any safety-critical product, it is essential when choosing a detector to ensure that it meets the relevant local and international standards. In the case of beam smoke detectors, minimum performance levels are stipulated by British Standard BS5839 part 5 and its European counterpart EN54 Part 12. However, a number of additional features may be needed either to simplify the work of the installer or to ensure efficient operation for the end-user. For example, most manufacturers incorporate a visual signal, usually a flashing LED, to identify clearly the point at which transmitter and receiver are perfectly aligned.

Fine-tuning the alignment is made easier if the transmitter produces a large-diameter beam. After installation, this feature will also help to combat slight misalignment caused by movement of the building.

Some manufacturers produce analogue versions of their beam detectors. These products feature two-way communication with the main control panel using industry standard protocols, and are ideal for incorporation into complex fire protection systems involving large numbers of other devices.

Detectors, which combine the transmitter and receiver in a single module, have recently been introduced. These products, which can cut installation costs by halving the number of devices requiring cabling, work by directing the infrared beam to a small reflector fitted to the opposite wall. More suited to environments with predominantly non-reflective surfaces rather than those with extensive glazing, "all-in-one" reflective detectors are best seen as a complement to established two-head technology rather than a replacement.

CHANGING ENVIRONMENTAL CONDITIONS

Beam detectors of all types generally feature automatic drift compensation, a signal processing function, which counteracts gradual changes in the light intensity registered by the receiver. The most common cause of a slow fall-off in signal strength is the accumulation of dust on the receiver lens over a period of time. However, movement of the building can also be responsible, as after a while the receiver may no longer be aligned with the brightest point of the beam. In either case, drift compensation is essential if the detector is not to be "fooled" into registering an alarm.

A further weapon against unwanted alarms is the ability to distinguish between genuine obscuration by smoke and obstruction by opaque objects. Flying insects and birds can cause momentary obstruction, while blockage of the beam may be caused by a tall obstacle such as a scaffolding tower inadvertently placed in the way. The detector's software must be able to able to differentiate the total loss of signal caused by these events from a partial reduction caused by smoke. In the case of a continuous obstruction, it must also register a fault condition to alert the user to the problem.

Beam me up, SAFELY

The electronic controls associated with a particular detector can either be incorporated into the receiver and transmitter modules themselves or removed to a wall-mounted control unit accessible at ground level. The latter system, however, is significantly easier to use. The user can check alarm and fault status, and carry out control functions such as resetting drift compensation levels, at any time and without the intrusion of ladders or lifting gear in the work-place. In addition, simple control functions can be accessed locally without having to go to the building's main fire control panel. Moreover, the removal of the control electronics from the detector heads helps to maintain the compact size and competitive price of these items, an important consideration when removal or replacement is needed.

Beam detectors are ideal for factories and other commercial premises with large indoor spaces and high ceilings.

Klaxon
The first name in signals

Sound ALERT

Standalone directional sounder manufactured by Klaxon Signals.

A Sound Evacuation Solution

A new type of fire alarm sounder, which can guide the occupants of a building to the emergency exits, is set to make life a great deal safer for all of us. This new technology allows those with impaired vision, or any occupants of a smoke-filled building, to make a safer and quicker evacuation in the event of an emergency. Because fatalities in fires are often caused by inhalation of poisonous smoke, this will help save lives.

The 'Localizer' alarm has been developed by Sound Alert Technology plc, a company that develops innovative products based on research by Prof. Deborah Withington and a team of scientists at Leeds University, and manufactured in partnership with Klaxon Signals, leading suppliers of sound signalling products.

Conventional fire alarm sounders merely alert us to the presence of danger; it gives no information concerning the direction to, or location of, the nearest emergency exits and therefore relies on people's ability to find their way out using exit signs. Even if such an alarm were to be placed over an exit door, we would not be able to find it because a conventional alarm produces a sound, which our brain cannot localise. In other words, it is difficult to distinguish where the sound is coming from. Voice evacuation systems can tell us where to go, but the problem is that they cannot show us how to get there. In order for alarms to be located by the brain, the frequency content of the sound has to be as wide as possible (20-20,000 Hz) and is the reason why conventional alarms will not work in this situation.

Localizer directional sound technology is a broadband, multi-frequency sound (or "white noise"), whose direction can be easily detected by the brain.

The Localizer sounders fitted in addition to existing bells or sounders allows people to move towards the nearest exits and also offer intuitive guidance as to whether to go up or down stairs. Used in conjunction with modern analogue addressable fire detection systems, which can determine the seat of fire, a preferred evacuation route can be set by triggering the appropriate Localizer sounders. In combination with Voice Evacuation systems, it is possible to educate people on the use of the system when it is needed, even if they did not possess prior knowledge.

In recent trials filmed for a Channel 5 documentary, half of the evacuees in a first test using conventional fire alarm sounders failed to locate the emergency exits in time and would have died due to smoke inhalation or the fire itself. In a second test, this time utilising Localizer sounders, all escaped successfully in less than half the time.

In addition, Localizer has received extensive TV coverage, having been featured in the BBC World Service, BBC's "Tomorrow's World" and "999 Lifesavers" as well as achieving widespread press coverage, including articles in British broadsheets, New Scientist and The New York Times. On top of this, Localizer has already won a number of awards: the Fire Industry Council Product Innovation Award in 2001, judged by a panel of Fire Industry experts; three DTi SMART awards in the period from 1994 to 1997; the prestigious Prince of Wales Award for Innovation as well as a special award for the product with the greatest commercial potential; and finally, Localizer had been awarded Millennium product status by the Design Council (in the form of emergency vehicle sirens and evacuation beacons).

The technology is not just limited to buildings, but can also be utilised for marine, railway and airline applications where a controlled evacuation would be crucial in an emergency. Furthermore, Localizer has the benefit of international applications that are totally independent of language constraints.

Prof. Deborah Withington and Mike Lunch, Managing Director of Sound Alert Technology plc, with a lab prototype.

For further information of this technology or for a demonstration, please contact Klaxon on +44 (0) 20 8952 5566 or e-mail sales@klaxonsignals.com.

SPEAKING OUT

The argument for voice alarms – by Bob Choppen

Pic: courtesy of Fulleon Ltd

It is a staggering fact – one that has been widely accepted for nearly three decades – that only around one in six people, when confronted with a fire will react in an appropriate manner when an alarm sounder is activated. For most people, the reaction is a peculiar mixture of fascination and fear. Without information that can be evaluated, an individual's behaviour in a fire may, in practice, be influenced more by a search for knowledge, than a desire to escape.

The difficulty in identifying the meaning or significance of an alarm signal is undoubtedly a major contributing factor. While BS 5839 Part 1 recommends a frequency range for fire signals – continuous for "evacuate" and intermittent for "alert" – the choice of sound – steady, sweep, two-tone etc – is a matter for the system user to select – any sound that is not similar to other alarms used within the premises. In these circumstances it is not unreasonable that the public has difficulty differentiating between a fire alarm signal and the plethora of other alarms that clutter contemporary life.

Regular occupants of a building should be trained to recognise an alarm signal, and then react appropriately in response. The general public visiting the building are an entirely different proposition. They have had no training to enable them to identify a fire alarm signal, a situation made worse by the facts that they may well be used to a different signal in their normal place of work, and have no idea of the correct evacuation procedure.

ACCORDING TO BOB CHOPPEN, Product Manager at Fulleon, the reason for fire alarms being so frequently ignored comes down to the fact that the public simply does not understand what they mean. He argues that lives could undoubtedly be saved if voice options were more widely adopted in a wide range of building types and sizes.

This is a glaring, and long-standing weakness, made worse by the fact that there is little prospect of a standard alarm signal being adopted country-wide. So, the only viable option is to seek an alternative; and that is where voice-based alarm systems have so much to offer. Evidence already exists to show that they are effective with about 70 percent of the population – a significant and very worthwhile improvement over conventional alarm sounders.

Indeed, the case for the wider adoption of voice techniques is compelling. Unlike sounders, they can do much more than inspire the public to the need to evacuate. Many factors have a bearing on the behaviour that needs to be inspired in an emergency. These include the building's size, its design, even its location. For example, larger buildings may require phased evacuation to avoid the choking of escape routes, or occupants may need to be instructed to take actions that are not intuitive, possibly to exit the building by a less than immediately obvious route.

There are also occasions, even with well-drilled occupants, when the emergency is so unexpected that established routines and pre-planned strategies have to be overridden. In these cases, voice notification provides one of the few effective solutions. Although "alarm" is the prime purpose for a voice system, benign conditions, such as "system test" and "all clear", can be communicated without causing stress or disruption, or leading to the alarm being misconstrued as "just another test" in a real emergency.

Pic: courtesy of Fulleon Ltd

THE AVAILABLE VOICE OPTIONS

There are a number of options for providing fire detection systems with a voice alarm capability and they vary in both cost and complexity.

Public Address Voice Alarm (PAVA) systems top the list. These are designed and installed to comply with the recommendations of BS 5839 Part 8. "Code of practice for the design, installation and servicing of voice alarm systems" and are tailored to match the user's precise needs. Generally, they are based on established public address technology that is enhanced to provide levels monitoring and security appropriate to the fire detection system they are partnering.

In most instances, PAVA systems are separate to the fire detection equipment, although connected to it via highly secure monitored interfaces. There are also systems where the voice capability has been integrated to some extent with the fire detection system. These may offer technical advantages by avoiding duplication of functions and improved interfacing, but may lack the ultimate flexibility and non-fire capabilities of a separate PAVA system.

At the other end of the spectrum is the voice sounder. As its name implies, this equipment utilises alarm sounder technology to provide an integrated message unit that can be used either standalone or in multiples, in much the

> *In between PAVA systems and voice sounders are a growing number of innovative voice products that combine technologies and system configurations that blur the differences between fire detection, public address and voice sounders.*

same way as conventional alarm sounders. Although they are far more limited in their capabilities than PAVA systems, lacking any live voice facilities, their cost and simplicity means that they are a realistic option in many circumstances. Clearly, while both PAVA systems and voice sounders provide information using voice messages, each is suitable for different applications.

Not that these are the only two options. In between PAVA systems and voice sounders are a growing number of innovative voice products that combine technologies and system configurations that blur the differences between fire detection, public address and voice sounders. All are finding uses in fire and safety applications, but their very diversity makes an assessment of suitability difficult and confusing for potential specifiers.

THE SYSTEM MANUFACTURERS' CHALLENGE

The absence of equipment standards for voice alarm products used in a fire context is a challenge for the industry. BS 5839 Part 8 is a code of practice for "Installation design and commissioning" but, of necessity, includes recommendations for equipment configurations and monitoring that will ensure the safety and reliability needed for PA based systems. Only brief mention is given to voice sounders in an Appendix of Part 8, so manufacturers have to take suitable extracts from a number of other sources, and the most closely related to voice sounders is the Audible Alarm Devices standard, BS EN 54-3. The issue with this standard though is that this is intended to cover much more basic design issues than those involved in producing speech with decent clarity.

In the absence of any other guidance, it could be argued that all voice products should follow the general advice given in BS 5839 Part 8, as the objective is the same: to warn and inform using speech messages. However, Part 8 is based solely on the technology of PA systems, the recommendations for which may not be wholly appropriate for other technologies. So, if applied indiscriminately, this approach could inflict unreasonable cost and technical constraints.

Pic: courtesy of Fulleon Ltd

SPEAKING OUT

The argument for voice alarms

APPROPRIATE APPLICATIONS FOR VOICE ALARMS

A compliant PAVA system is the obvious choice for applications such as shopping malls and hotels, airports and other major building complexes that attract substantial numbers of people who are not familiar with the surroundings and are therefore likely to be disorientated in an emergency. Such installations usually rely on recorded messages as the initial automatic response, but it is their capacity to broadcast live voice instructions that gives the flexibility to adapt information to often rapidly changing emergency conditions.

Most environments can be tackled with reasonable acoustic and aesthetic success, thanks to the availability of a selection of loudspeaker formats. The facility to utilise the installation for non-emergency uses, such as background music or staff and public announcements is a bonus. A PAVA system can therefore earn its keep during non-emergency periods, which additionally provides a valuable monitor of the operating condition of the system, although care is needed to ensure that these additional uses do not impede any emergency operation.

The cost of the equipment and installation is the biggest deterrent to installing PAVA systems. In medium-to-large sites, a comprehensive PAVA system could put an additional 50 percent to 110 percent on to the cost of the fire detection system. For small premises, unless there is a special set of risks, the basic cost of a PAVA system is a strong disincentive to its use.

While the need for a voice alarm in smaller premises is arguably less critical because of the simplicity and more predictable nature of the evacuation procedures, there remains a need that is not being met by PAVA options.

For these smaller or less complex applications – banks, clubs and retail outlets, for example – that require less functionality, the significantly lower cost of voice sounders and voice sounder systems make them a viable alternative. They are also especially appropriate for defined areas of larger buildings, where a specific risk is present. A voice sounder could be used to provide toxic spill alerts in a laboratory for example or a warning prior to gas discharge in fixed extinguishing systems.

Today's generation of voice sounders do not support paging or background music, but they do offer the twin benefits of being cost effective and no more complicated to install than conventional sounders. This enables voice sounders to be an uncomplicated upgrade from normal sounders, without the considerable installation penalties associated with PAVA systems.

ASSESSING THE AVAILABLE OPTIONS

With the diversity of costs and specifications for voice systems, the difficult task is ensuring that the system being considered is fit for life safety use, and the specific circumstances of the application. In most cases, there is little option but to rely on the advice and guidance of the system vendor. However, without relevant standards on which to rely, subjective appraisal may be all that is available.

The main criteria for a voice system must be how well it conveys information to its intended audience. So a vital question that needs to be answered is how the clarity or intelligibility of the speech reproduction is to be assessed? BS 5839 Part 8 recommends a minimum target intelligibility rating of 0.5STI for the installed system, but acknowledges that there may be considerable cost and difficulty in performing objective tests and suggests measurements may only be appropriate in case of dispute.

The STI figure of 0.5 is based on the ability of the listener to hear and understand the message at one hearing, (the various test methods using speech specifically avoid repetition). This is essential with live-voice messages, as they may only be broadcast once and, even if repeated, could include differences between repetitions. It should also be remembered that, while the system may be capable of achieving 0.5 STI under test conditions, the variation in technique between microphone users could well affect the clarity of messages to a degree that is not easy to define. In some acoustic environments, swimming pools being a good example, achieving 0.5 STI simply may not be possible, regardless of the quality of the system or the competence of the system designer.

Part 8 recommends that any one of the methods for intelligibility assessment described in BS EN 60268-16 may be employed to determine a value of STI. All of the techniques listed are appropriate where the equipment can cope with live audio inputs, but are unworkable where short, recorded messages are employed, as with voice sounders or the automatic message stores used in PAVA systems.

There is, consequently, a need to devise a method of testing that can be reliably applied to all systems or parts of systems relying on recorded messages.

The suggestion in BS 5839 Part 8, that measurement of intelligibility is only necessary in case of dispute is acceptable in most cases and subjective assessment may be adequate. The difficulties arise further down the line. If system performance changes over time and the person who accepted the system is no longer present, what benchmark can be used for comparison? Also if investigation is required after an emergency where injury occurred, what evidence can be offered as to the effectiveness of the voice system? – *"it sounded alright to me"*.

PAVA systems will, undoubtedly, remain the accepted solution for larger premises, but cost will continue to seriously limit their use in smaller installations. Voice sounders are finding increased use in a diverse range of applications, but have, as yet, no design standards or suitable method for speech quality assessment.


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2nd International Water Mist Conference in Amsterdam

After the first successful annual conference in April this year in Vienna, Austria, the venue and date for the 2002 symposium have been determined recently. This event to be organized by the IWMA is, hence, the 2nd International Water Mist Conference. The conference is scheduled for April 10-12 and will be held in cooperation with independent institutions who are members of the IWMA. They are going to provide the necessary scientific support for the symposium. The Parkhotel in Amsterdam, The Netherlands, was chosen as next year's location.

Interested parties are asked to browse the association's web page (www.iwma.net), which offers all necessary information regarding this upcoming symposium. The IWMA office can also be contacted for detailed information on registration, accommodation and more. Please see the contact information on the bottom of the page.

The conference will provide a good opportunity for fire safety experts and university researchers, representatives of interested corporations and governmental authorities as well as potential end users to review the current situation, to increase their knowledge and to discuss future directions of water mist technology for fire fighting.

Photo courtesy Swedish National Testing and Research Institute.

Attendees of the 2nd International Water Mist Conference 2002 who would like to present a paper at the symposium may submit an abstract of the paper no later than 31 January 2002. In general, the paper should refer to one of the following topics: research, new applications, testing, environmental issues or standards and codes. The conference may be sponsored by interested organizations. Interested companies should please contact the IWMA office for detailed information on sponsorship possibilities.

Park Hotel – Amsterdam

Annual member meeting

The IWMA annual member meeting will take place during the conference week in Amsterdam, The Netherlands, in the Parkhotel respectively. The business year 2001 and outlook for 2002 and beyond are going to be discussed in detail. Particularly the necessary election of the IWMA board for the next three-year period will be a major part of the meeting. All members of the IWMA will receive a separate invitation at least 4 weeks in advance. Interested parties who are planning to become a part o the IWMA in the near future are invited, too.

Database for literature on water mist

Recently, a non-exclusive list of literature on water mist fire suppression technology was added to the IWMA homepage. This list comprises about 200 articles available on water mist technology that can be ordered for a low fee by members as well as non-members. However, the copyright fully applies. That implies that articles are limited to one copy each and for private use only. One can simply contact the IWMA office if there is interest in particular publications. However, the available list is only a beginning, though. We would like to encourage people who are aware of any other references that could be added to that list, to inform us about these references so that the list can be completed gradually.

Educational Seminar was conducted

About 30 people interested in water mist technology for fire fighting have been educated in a two-day seminar on October 18 and 19 in Germany. Some experts and IWMA members have explained in a number of presentations to architects, consultants, representatives of insurance companies and other companies being not so familiar with water mist yet, the fundamental theoretical and functional characteristics of this technology. Furthermore, the various possible applications as well as the current situation concerning standardization projects were introduced to the attendees.

Photo courtesy Swedish National Testing and Research Institute.

Moreover, a few real 1:1 fire tests were found to be useful in order to illustrate the extinguishing qualities and the mode of operation in reality to the participants of the seminar.

It is planned to offer similar educational seminars in other countries also to make this technology accessible to others as well.

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Chemetron Fire Sys

Chemetron Fire Systems™ (and its predecessor company, **Cardox®**) has been in the special hazards Fire suppression systems business since 1939. Currently we offer systems utilizing:

- **Carbon Dioxide (CO_2)**
  Both high pressure (cylinder storage) and low pressure (bulk liquid storage)
- **FM-200®**
  A gaseous agent for protecting normally occupied spaces and the most widely used Halon 1301 replacement
- **Argonite®**
  An inert gas mixture of nitrogen and argon that is also used in the protection of normally occupied spaces
- **Water Mist**
  A limited water supply is discharged under high pressure to produce a very fine water spray; uses significantly less water than a standard sprinkler system.
- **CLASS™ Air Sampling Detection System**
  A laser based smoke detection system for early warning applications.

AS A SYSTEMS INTEGRATOR, Chemetron designs systems to meet the special needs of critical operations that are especially sensitive to the effects of fire, its products of combustion, or ordinary fire extinguishants (i.e., water and dry chemicals). From our headquarters based in the Chicago metropolitan area, we manage a worldwide operation that includes an international distributor network and an internal sales force supported by a highly qualified and experienced Applications Engineering and System Design group, as well as our own Research and Product Development group and testing facility. Our Field Service department supports system installation, commissioning, testing, servicing, and system monitoring requirements.

The applications for Chemetron fire extinguishing systems are wide-ranging. Many include the development of innovative protection methods that have proven to be exceptionally effective in actual fire situations. The more popular applications for each of these agents include the following:

FM-200

This agent is used extensively in the protection of computer and telecommunication facilities, as well as control rooms, various research facilities, etc. FM-200 is a chemical agent that is stored as a liquefied gas, pressurized by nitrogen, in cylinders ranging in size from 4.5 kg (10 lbs) to 450 kg (1,000 lbs). Larger amounts of gas can be provided by simultaneously discharging multiple cylinders. It is applied as a total flooding agent, wherein the protected space is "flooded" with a low concentration of agent (usually around 7% by volume). This effectiveness gives it the advantage of requiring less hardware for storage. FM-200 is used in tens of thousands of fire suppression systems, in more than 70 countries around the world. It is truly the most widely accepted clean agent in the world.

Argonite

This agent is a mixture of 50% nitrogen and 50% argon that is stored at very high pressures (200 bar) in cylinders manifolded together to provide the gas required to reduce the oxygen level in the protected space to the point at which fire can no

tems Matteson, Illinois, USA

longer burn. It is used in many of the same applications as FM-200. The advantage offered by an Argonite system is that it uses naturally occurring gases with no ozone depletion potential and no direct global warming risk. Its disadvantages are the large amount of equipment required and the pressure venting needed upon agent discharge.

Water Mist

These systems are application specific in that the system approval testing procedures are based on fire testing in actual applications. Current application approvals include turbine enclosures and machinery spaces. Machinery spaces cover a wide range of industrial operations, including compressors, hydraulic pump rooms, paint spray booths, oil purification rooms, combustible liquid processing/storage, etc. The system consists of either a water storage tank, pressurized by the release of nitrogen into the tank when a discharge is needed, or by the operation of a positive displacement pump. The design is based on a mist discharged from specially designed nozzles, with each nozzle covering a specific segment of the protected hazard.

Carbon Dioxide (CO_2)

Carbon dioxide has been a universally used clean agent for over 80 years. It extinguishes fire by oxygen dilution, but at levels that are hazardous to personnel. Hence, in total flooding applications, it is not used in normally occupied spaces without the implementation of a comprehensive safety program covering the system and personnel. In total flooding systems, an advantage that CO_2 has over other inert gas extinguishants is that it can be liquefied in storage at normal ambient temperatures. As a result, less equipment is required, saving storage space and money.

More importantly, when CO_2 is discharged it produces finely divided particles of dry ice that quickly sublime, but not before they can be projected onto an unenclosed hazard, enveloping it in the CO_2 and extinguishing the fire. While partial enclosures help contain the CO_2, they are not necessary for fire extinguishment. This method of extinguishment is called local application and its use greatly expands the applications for CO_2 systems. Hazards, such as metals rolling mills, printing presses, heat-treating facilities, etc., have had great success in extinguishing fires with CO_2 applied by local application. Local application can be combined with total flooding coverage to protect hazards that are subject to spillage, leakage, dripping, condensation, etc., to provide total coverage and protection of an entire hazard.

CO_2 is a very good inerting agent and can also be used in a combined system providing both fire suppression and inerting. An example would be an indirect coal firing system. The coal mill and associated duct work and cyclone can be protected by a system offering both fire suppression and inerting, while the dust collectors have suppression and the enclosed conveyors and the pulverized fuel bins have inerting with the capability to suppress smoldering fires buried in the coal.

Chemetron offers both high pressure (cylinder storage) and low pressure (bulk liquid storage) systems. We originated the use of low-pressure type systems with patents issued in the 1930s. Since that time, tens of thousands of systems with hundreds of applications have been installed. We have documented about 50 of the more popular applications in a series of Technical Applications Bulletins that are available upon request.

Obviously, the availability of various types of systems with all their varied applications can make the job of determining what is best for a specific application very difficult for the layperson. Our many years of fire suppression experience enable us to assist clients in the consideration of all legitimate fire protection options for any special hazard application and to provide the most efficient and effective fire protection system possible.

Air Sampling

The Class Detector (with dynamic sensitivity range of 0.00075% to 0.3%/ft) is designed for early warning smoke detection applications such as telecommunication facilities, data processing facilities, museums, and warehouses.

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NFPA20 Fire Pumps and Controllers

MATTHEW ROY, ROB HARRIS & SANDRO PALIOTTI

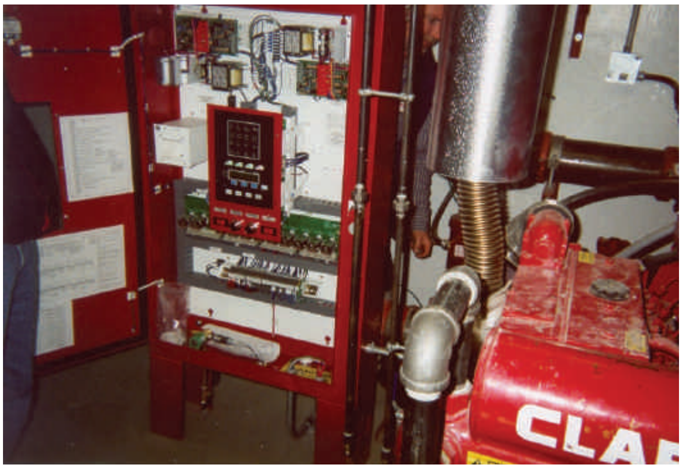
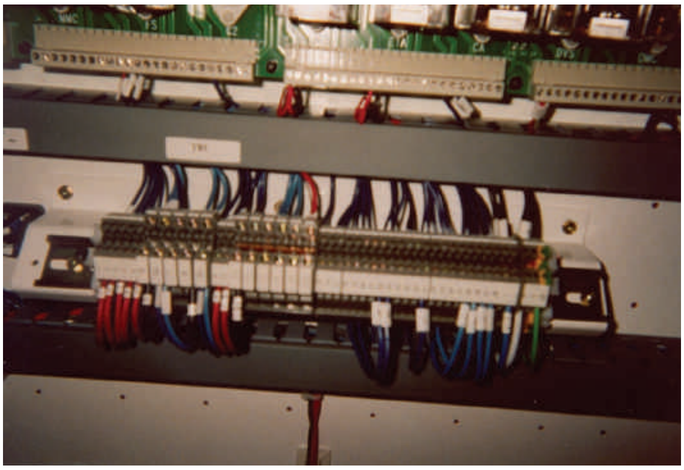
FM approved horizontal split-case packaged fire pump system. Factory packaged systems can eliminate the problems with incorrect wiring, a common problem with fire pump installations.

The NFPA standard for installation of fire pumps (NFPA20) has gained global acceptance as a means of ensuring reliable water supply to a fire protection system. This is in part due to the fact that the standard clearly defines installation and design requirements while respecting limitations of specific locations and jurisdictions. This global acceptance is also due to the fact that the standard provides a means of attaining consensus between building owners, insurance underwriters, fire protection authorities, installing contractors, designers, and manufacturers in what constitutes adequate fire protection. Probably the most important part of the consensus building process is the startup. Defined in Chapter 11 of NFPA20 (1999 Edition), the NFPA startup procedure emphasizes the responsibility of the fire pump manufacturer in ensuring equipment performs to site conditions. Of philosophical importance is the fact that Chapter 11 is entitled "Acceptance Testing, Performance, and Maintenance". The term "Acceptance" implies that the startup is the final approval of the equipment installation and performance. This article will highlight some of the critical considerations in the proper installation of an NFPA20 compliant fire pump installation. The intent of the article is to prepare facilities owners or managers for the acceptance test to be performed by the manufacturers' representatives for diesel driven fire pump systems.

PRE STARTUP

A pre startup is the most important step in the on site acceptance of a fire pump. The pre startup of the fire pump should be performed once the sprinkler contractor has completed the installation of the fire pump system. The purpose of the pre startup is to ensure that the installation is ready for final commissioning of the fire pump system. A representative of the building owner or installing contractor can do the pre-startup; however, it is recommended that the pump manufacturer's representative be contracted to perform these checks to ensure the pre startup is performed satisfactorily.

The NFPA 20 code states that the fire pump manufacturer's representative must contact and arrange for a fire pump controller and diesel engine manufacturers' representative to be on site for start up purposes, if required. The co-ordination of all parties required at the start up is often the most difficult item to arrange. In some cases, very little notice can be given (there can be less than one week from final installation to start up date). As such, an incomplete pre startup can be costly since pump, controller, and diesel engine service engineers usually charge for a single site

It is critical to check the wire sizing and terminations both in the diesel engine instrument panel and the fire pump controller to ensure proper operation of the system.

visit in the contract to purchase the fire pump. Additional commissioning costs can be incurred if the startup requires a second visit to the job site.

The first step of the pre startup verification is to ensure that the fire pump and all the components of the fire protection system are installed in accordance with NFPA 20, and are free from damage. Particular attention should be paid to the connections. Flanges should be flush with each other. Poor connections can cause leaks and indicate pipe strain resulting in damage to fittings or loss of pump alignment.

Of critical importance is the supply piping and water source. There should be no devices that may restrict flow from the water source to the suction of the fire pump. Exceptions to this are strainers for vertical turbine or close-coupled pumps, and listed supervised gate valves.

Fittings should be installed in accordance with the NFPA standards. Diagram A illustrates the proper installation of a fire pump system. Of particular importance is to ensure fittings are installed in the proper direction of flow. Unidirectional flow fittings always have an arrow to assist the installer in proper installation.

Also of importance is to check that equipment is listed by UL or FM. This includes the suction OS&Y gate valve, discharge check valve, discharge butterfly valve, and all indicating isolation valves in the system. All components should be sized in accordance with NFPA 20 table 2-20, including suction and discharge piping.

A hose valve header should be installed on the outside of the building to allow measurement of the pump flow rate for the approval test and annual flow test. The hose valves connected to the header should be listed for fire pump service. If the hose header is at a distance from the pump and there is a danger of freezing an indicating butterfly valve and ball drip valve must be installed.

If a flow meter is installed to measure the fire pump flow rate, this meter must be listed for fire pump service and installed in the proper direction, with flow returning to pump suction or outside header. The flow test loop should be isolated to allow for removal of the metering equipment for servicing at any time. The flow meter gauge must have a range of at least 1.75 times the rated flow of the pump. Of note, flow meters require minimum lengths of straight pipe upstream and downstream in order to accurately measure flow. The manufacturer's installation and maintenance manual should supply this information; however, a good rule of thumb is to install 10 pipe diameters upstream and 5 pipe diameters downstream of straight pipe around the flow meter.

A main relief valve is required on all systems where the pump shut off pressure plus the static pressure exceeds the pressure for which the system components are rated. On a diesel system, a main relief valve is required if 121% of the net rated pump shutoff pressure plus the maximum static pressure exceeds the system component rating. The relief valve must be sized not less than is indicated in table 2-20, and must be installed between the pump discharge and the discharge check valve (refer to Diagram A). An isolation valve is not allowed on the line to the main relief valve. If the MRV is returned to the suction of the pump a circulation relief valve should be installed. A means of indicating flow such as an enclosed cone with sight glass should be provided.

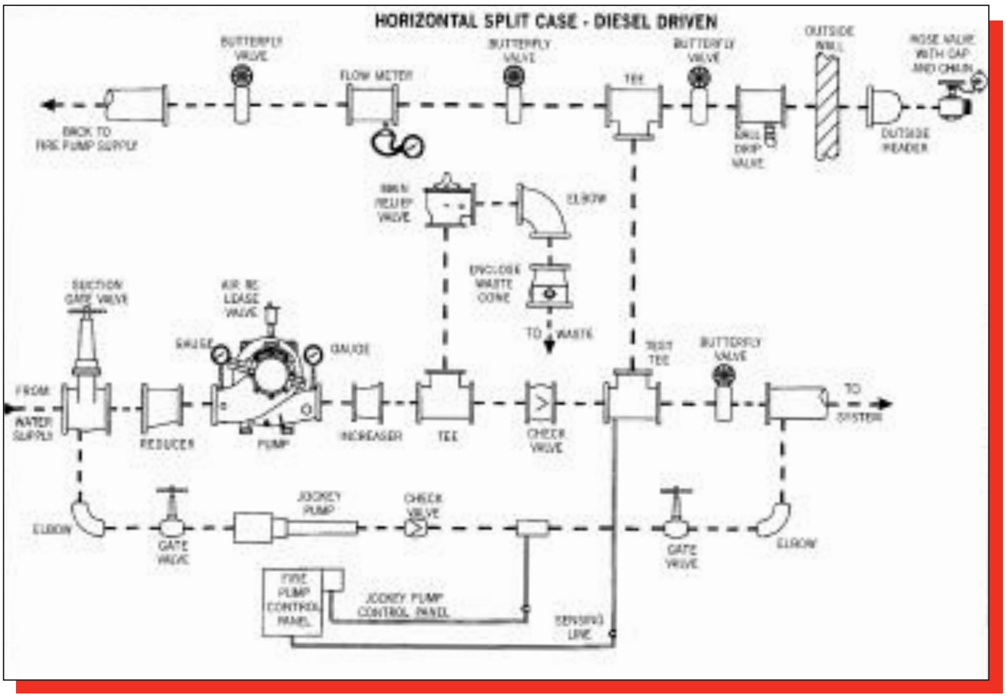


Diagram A. Fire pump installation as required by NFPA20.

JOCKEY PUMP INSTALLATION

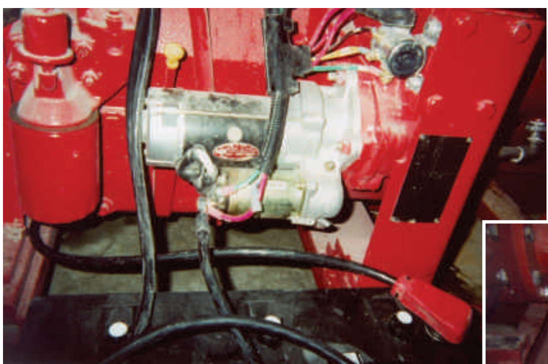
In order to maintain pressure in the fire protection system, and to avoid unnecessary starting of the fire pump, a pressure maintenance pump or jockey pump is required. In order to ensure proper installation of the jockey pump, verify that the jockey pump line is piped correctly. The jockey line should be piped as indicated in Diagram A. This piping arrangement ensures that the jockey pump can operate independently of the fire pump system and maintain system pressure during regular maintenance procedures on the fire pump.

THE PRESSURE SENSING LINES

Probably the most important aspect of a good fire pump installation is the quality of the fire pump sensing line. The sensing line is the only means by which an automatic start of the fire pump is initiated in an emergency. Per NFPA 20 A-7.5.2.1 (a) and (b), the fire pump and jockey pump-sensing lines must be independent of each other. The lines must be of $^1/_2$" (12.7 mm) non-ferrous metallic piping. Typically, copper lines are used with two check valves with $^3/_{32}$" (2.38 mm) holes drilled in the flappers. The check valves should open in the direction of the pump and should be separated by five feet (1.53 m) of piping.

FIRE PUMP MINIMUM FITTINGS VERIFICATION

Every fire pump includes set of minimum fittings as required in NFPA 20. It is important to ensure that these fittings are



Battery and grounding connections should be made per the manufacturer's recommendations. Batteries need to be filled with electrolyte and charged for 24 hours prior to the final acceptance test.

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NFPA20 Fire Pumps and Controllers

properly installed. A $3\frac{1}{2}$″ (89 mm) gauge should be mounted on the pump suction flange or pipe after the suction gate valve and on the pump discharge. The suction gauge should be of the compound type, having a range of 30″ of water (76 cm) to 150psi (10 bar). The discharge pressure gauge should have a range of at least two times the pump rated discharge pressure or a minimum of 200psi (14 bar). Isolation gauge cocks should be provided to allow for gauge service and replacement.

For diesel system where the relief valve has been piped to suction or radiator cooled units, a casing relief valve should be mounted on the pump discharge. This valve allows cooling of the pump casing during low flow operation and must be piped to a drain. Lastly, for horizontal split-case pumps, a $\frac{1}{2}$″ (12.7 mm) automatic air release should be mounted on the top of the pump casing to prevent air entrapment in the pump. Top discharge end suction pumps do not require the air release valve.

HORIZONTAL PUMP ALIGNMENT

Horizontal Fire Pumps are factory aligned before shipment. Due to the handling of the pump and the final leveling and grouting once it is installed, the alignment must be verified before commissioning. To check the alignment, use a straight edge and a feeler gauge on the coupling. Check that the straight edge aligns with both halves of the coupling at 90° increments around the coupling. Also verify the angular alignment with a feeler gauge. If the pump and driver are not aligned, the driver must be unbolted from the base and adjusted or shimmed as required.

As a final alignment check, turn the rotating assembly at the coupling. The resistance to rotation should be due to the inertia of the driver only.

DIESEL ENGINE INSTALLATION

Before starting up a diesel driven fire pump, it is important to ensure all the diesel installation requirements are met and that all the diesel accessories are installed properly.

Verify that a line is piped from the pump discharge into a tee, which supplies the cooling line on the diesel engine. The main cooling line consists of a solenoid valve, two isolation ball valves, strainer, and pressure regulator. The secondary line includes two ball valves, strainer and pressure regulator. It is critical for engine cooling that the cooling loop solenoid is wired correctly to the “W” terminal on the instrument panel, and that the drain connection from the heat exchanger is piped to drain. The voltage supply to diesel controller and engine block heater is within 10% of the voltage on the controller nameplate.

The fuel system should also be checked for proper installation. Diesel engines are supplied with a fuel tank sized for 1.1 US gallons per HP of the engine (5.57 L/kW) according to NFPA20 requirements. The fuel tank supply line must have an isolation valve, and the fuel return line should have a check valve with no isolation valve. Proper spill containment for the tank should be supplied (if a double wall tank has not been installed).

One of the most critical pre-startup considerations is that the engine and engine system has been primed with necessary fluids. Engines are generally shipped without oil and coolant, and lead-acid batteries are shipped in a dry charge state. Batteries must be charged 24 hours prior to startup.

Adequate ventilation and temperature conditions are critical to diesel engine performance. The control room temperature should be above freezing and below 120°F (49°C). Adequate supply air to the engine and exhaust ventilation to remove hazardous vapours should be provided as per section A-8.3 of NFPA20.

Engine exhaust piping should be insulated to protect personnel from injury and must be installed with at least 9″ of clearance from combustible material. Exhaust piping should be sized to ensure pressure losses do not exceed the back pressure allowance for the engine.

DIESEL ENGINE CONTROLLERS

In general, incorrect wiring is the most commonly found error found in fire pump controller installations. By code, the controller manufacturer is required to permanently mount electrical wiring schematic diagrams on the inside of the controller. Typically these diagrams also include field connections and wire size information.

Care should be taken to ensure that the correct wire size, as recommended by the engine manufacturer, is connected between the diesel engine batteries and the starter solenoid on the engine. Failure to install the correct wire gauge can cause voltage loss throughout the entire system, resulting in failure to crank during a call to start situation. Further verification of wire sizing between the engine control box and the diesel fire pump controller should be made. If the gauge of wire recommended is not installed, the controller may not receive the minimum amount of voltage required to function correctly.

One of the major causes of erratic behavior by a controller is in the grounding connections throughout the system. All grounding points in the system must be thoroughly checked as part of the wiring inspection. In many cases the wiring connections are made on the engine or skid to points of easy access. However, the points of access are frequently painted over during the process of mounting the pump and engine to the support base. When connecting the ground wires at these points, great care should be taken to ensure a proper electrical ground is achieved.

Another wiring point to examine is the actual field wiring. Some manufacturers have specific “point of entry” areas for incoming wires. If these have not been used, and a separate entry point has not been cut, it is possible for steel shavings to have lodged into components causing them to behave erratically or fail. Frequently, the electrical installation point has been cut before the controller door has been opened. Upon inspection, it can be seen that a specific point of entry is required. Failure to meet this requirement can void the warranty on the unit.

Ensuring that you have a copy of the controller manufacturer’s commissioning checklist is a must, as many of the manufacturers require a startup report to be filed to ensure that the manufacturer’s warranty is in place. Additionally, basic information such as contact names and phone numbers can prove invaluable should you need to contact someone for assistance once on site.

Though there is a set of manuals included with each controller (required by NFPA 20 code), it is recommended to contact the pump or controller manufacturers’ representative for a backup set. These are usually available free of charge.

CONCLUSION

The NFPA20 code provides guidelines to ensure that a fire pump system will perform in an emergency condition. The on site acceptance test is critical to the assurance of this fact. If the above checks are made following installation of the fire pump, the chances of problems at the startup are drastically reduced. Upon completion of the startup, you can be assured that your property and its occupants are being provided with a globally acceptable standard of protection. This is as important as the peace of mind it can provide.

MATTHEW ROY is the Marketing Manager for the Armstrong Fire Pump Product Group. He is active in many industry associations, and is a Principal Technical Committee Member for NFPA20 – The Standard for the Installation of Stationary Pumps for Fire Protection.

ROB HARRIS is the Fire Pump Controller Product Marketing Manager for Cutler-Hammer and an active NFPA member.

SANDRO PALIOTTI works as a consultant in the plumbing and fire protection field, participating in the design, documentation, and approval of NFPA compliant fire pump systems.

Application of Fire Resistant Coatings to Structural Steel

Pic: courtesy of Nullifire Ltd

By **Ron Smith**
of the Association Of Specialist Fire Protection (ASFP)

IN A PREVIOUS ARTICLE, I discussed the various types of coatings used in the UK and Europe for the fire protection of structural steel elements of construction. I would now like to discuss the application of such materials. At a first glance, the application of such materials appears to be very simple, but surface preparation is of prime importance for coating materials. It is therefore my intention to split the requirements into two separate sections – one covering sprayed materials and one covering intumescent coatings.

SURFACE PREPARATION (GENERAL)

Surface preparation is of prime importance to ensure that a proper bond is obtained between the substrate and the applied coating. Consequently, the nature of the substrate, its shape and its girth are very important items to consider. Basically substrates can be divided into absorbent surfaces; such as brickwork, lightweight blocks, timber etc, and non-absorbent surfaces; such as steel, aluminium, etc.

The condition of the substrate to be coated is of great importance, but it should be noted that the geometric shape of the substrate also plays a significant part in how the coating will bond to the surface to which it is applied. For example, a coating applied over a suspect paint film to a flat steel surface will quickly lose adhesion in a fire, but the coating applied to an "H" steel section is more likely to remain in position in a fire because of the "H" shape and the re-entrant angles of the section.

It is essential to remember that the security of the coating depends very largely upon the absolute adhesion to the surface to which it is applied. This is why it is essential that any substrate being treated should be free of all traces of rust, scale, dust, oil, grease, old paint films, mould release oil, etc. Even with a totally clean substrate it may be necessary, in some instances, to reinforce the coating or apply a bonding agent prior to the application of the coating.

SPRAYED MATERIALS

For many years, following their introduction in the early '30's, asbestos fibres were used as the main ingredient for fire protective spray systems. Since then, of course, technology has changed considerably and the asbestos fibres have been substituted with mineral wool, vermilculite, perlite and differing binding materials. Spray materials are considered to be lightweight coatings.

SURFACE PREPARATION

On very absorbent surfaces, the substrate should be pre-wetted prior to the application of the spray material. This will prevent excessive suction of the water from the spray application and will result in a better bond between the spray and the substrate. Alternatively, the substrate could be sealed with an adhesive and the spray material applied whilst the adhesive is still "tacky" (wet). If an adhesive sealant is to be used, test evidence should be provided that the sealant is suitable for a fire protective application.

The spraying of non-absorbent substrates will depend entirely upon the

Pic: courtesy of Sharpfibre Ltd

nature and shape of the substrate. As mentioned above it is necessary to consider the basic shape of the substrate. On large flat steel surfaces it may be necessary to provide mechanical retention to the spray coating. BS 8282 – 1: “Code of Practice for the selection and installation of sprayed mineral coatings”, provides full details of how to fit various types mechanical retention for spray coatings. The Code states that mechanical retention should be provided unless:

There is evidence from the fire resistance test(s) to show that there is adequate bond between the spray coating and the substrate (including primers or other coatings); or

The spray coating is “locked” in position by virtue of the shape of the element (“H” section steel)

It is not normally required to provide mechanical retention to structural steel sections unless the depth of the section exceeds 650 mm between flanges or the width exceeds 325 mm across flanges. Reinforcement **must** be used, however, on circular steel sections with diameters greater than 325 mm or on hollow steel sections with a single face exceeding 325mm.

IMPORTANT ASPECTS OF APPLICATION

When dealing with the following points it should be borne in mind that portland cement, when wet, has an initial pH value of 12 to 12.5 and cement bound and lime-enriched gypsum mixes may attack alkali-sensitive substrates. Most sprayed fire protective materials contain such binders.

- It is essential to prime aluminium and aluminium alloy substrates with an alkali resistant primer in order to prevent chemical attack by the spray material. The application of alkaline materials to unprimed aluminium, or aluminium alloys, will start a reaction, which releases hydrogen. This will lead to a progressive breakdown of the aluminium substrate.
- Paints (primers) containing alkyd binders **must** be primed before the application of the spray material. There will be a bond failure of the spray coating unless such paints (primers) are suitably primed prior to the application of the spray material. It should also be noted that sprayed materials may attack paints (primers) containing water sensitive binders.
- Portland cement bound sprays should not be applied directly to unsealed gypsum plaster surfaces or plasterboard because the setting characteristics of the cement can be affected and there could be a loss of bond. Gypsum or lime based spray materials may be applied to certain types of plaster-based products but guidance should be sought from the spray manufacturer.
- It is not normally necessary to prime structural steel sections prior to the application of portland cement based sprays, provided the building environment is such that it will remain dry after construction.
- In continually damp conditions “white rusting” can occur to zinc coated steel, with a resultant corrosion of the base steel. It is therefore advisable to prime zinc coated (galvanised) steel with a primer system, which is compatible with the zinc coating, and the cement bound spray material.
- Timber substrates are subject to high drying shrinkage and moisture movement. It is therefore essential that a water-resistant sealer should be used prior to the application of the spray coating. Galvanised clout nails and spider web wiring can be used to assist retention of the spray.

INTUMESCENT COATINGS

An intumescent fire protective coating applied to structural steel will “swell” to many times its applied thickness when subjected to a temperature of around 200°–250°C. This “swelling” produces an insulating carbonaceous char, which reduces the rate at which the temperature of the steel rises, and prolongs its load bearing capability in a fire situation.

Brush, lambs wool roller or airless spray can be used to apply thin film intumescent

Pic: courtesy of Sharpfibre Ltd

Pic: courtesy of Sharpfibre Ltd

coatings. It should be noted however, that specialist contractors use airless spray and the "build up" of the coating to achieve the required thickness will be less with a roller. BS 8202-2 "Code of Practice for the use of intumescent coatings for providing fire resistance" provides details for application, etc.

SURFACE PREPARATION

Generally, steel erected on site will have been blasted and primed prior to delivery but, if this is not the case, the surfaces of the steel should be clean and dry before commencement of blast cleaning. It should be noted that blast cleaning might not remove all contaminants, which may need to be removed by other appropriate mechanical means. Oil and grease contaminants can be removed by the use of suitable emulsifying degreasers, suitable clean organic solvents or steam cleaning.

Steel surfaces should be prepared by removing scale and rust using abrasive blasting to a minimum standard of Sa$2^1/_2$ as defined in BS 7079: Part A1: "Specification for rust grades and preparation grades of uncoated steel substrates after removal of previous coatings" – or equivalent. All dust and spent abrasive must be removed from all prepared steelwork by blowing down with clean dry compressed air. Inspection of all the steel surfaces, and any corrective action required, should be carried out as described in Table 8 Work Stage B of BS 5493 "Protective coating of iron and steel structures against corrosion" and all primers, where specified, should be applied before the blast-cleaned surface deteriorates.

As mentioned above, in the majority of cases the steel delivered to site will have been blasted and primed. It is therefore essential, prior to the application of the intumescent basecoat that the applicator should seek confirmation from the intumescent coating manufacturer that the primer and intumescent basecoat are compatible in both ambient and fire conditions. The technical data sheet for the primer, the actual thickness of the primer, and the length of time that the primer has been applied should be given to the intumescent coating manufacturer, who should then be able to give approval for the use of the primer, or provide alternative advice.

In some instances it may be possible to apply the intumescent system onto unblasted steel, although the intumescent coating manufacturer must check this on a case-by-case basis.

IMPORTANT ASPECTS OF APPLICATION

Where a primer has not been specified, the steel surface should be prepared in accordance with BS 7079: Part A1 (mentioned above)

- The primer thickness should be within the tolerances specified by the intumescent coating manufacturer.
- The primer should be confirmed as being compatible with the intumescent basecoat in both ambient and fire conditions.
- The primer should be intact and free from damage and degradation.
- The primer should be within its stated over coating period.
- The primed surface should be clean, dry and free from all surface contamination.
- The adhesion of existing paint finishes on existing steelwork, or between paint layers, may be poor. It is also possible that the paint system may not be consistent throughout the building and that varying systems have been applied to different sections of steel. The only safe option is the complete removal of the existing paint coatings and the application of a primer, which should be compatible with the intumescent coating.
- Zinc rich primers, usually based on epoxy resin or silicate binders, are often used as corrosion protection on structural steelwork. During weathering, the zinc provides protection by sacrificially corroding and this can lead to the formation of zinc salts on the surface of the coating. It is essential that the zinc salts are totally removed prior to the application of the coating, for example; by washing down with clean fresh water. Applying a tie-coat over the primer at the fabrication stage can prevent zinc salts.

CONCLUSIONS

In a short article I have attempted to provide an outline for the application of fire protective coatings for structural steelwork. Obviously, it has been impossible to cover all the important aspects regarding the use of such materials. If further information is required, the following publications can be obtained free of charge from the Association for Specialist Fire Protection (ASFP) website: www.asfp.org.uk

Technical Guidance Note for the mechanical retention of Sprayed Mineral Coatings based upon the requirements of BS 8202-1

On Site Guidance Note for the Specification and Use of Site Applied Intumescent Coating Systems

Structural steel fire protection using intumescent coating systems in conjunction with existing paint layers and zinc rich primers.

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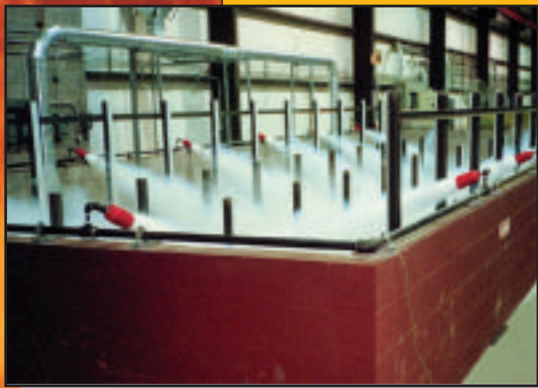

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Life Safety Systems

A Viewpoint from Logic Engineering Ltd (Ireland)

Editor's Note

We decided that it was important to look at some of the common problems that occur with Fire Alarm installations, from the viewpoint of a successful installer of Life Safety Systems. Here, **Logic Engineering Ltd (Ireland)** talks us through some of the problems that occur with installations in the Irish fire industry. We think you will find comparative examples wherever you are based throughout the world.

As a supplier and installer of EST Life Safety Systems in Ireland, we regularly try to anticipate any installation problems that may arise during a project and when problems do occur, we work to address them as quickly and effectively as possible.

The first common problem installers often need to address is client knowledge. As a top priority, installers need to ensure the systems they use are well recognised by prospective clients. To increase the familiarity and understanding of EST products in Ireland, we make representations to engineers, electrical contractors and customers to demonstrate the advantages of high technology fire alarm systems. We feel compelled to explain the benefits of our systems over standard analogue addressable systems and demonstrate that an itemised schedule of rates is not always a definitive guide to the overall cost of owning a fire alarm system.

For this reason, we have undertaken a program to assure everyone in the project chain, from engineers to foremen to contractors, that installation is simplified – we have found demonstrations successful in illustrating this point. For the client, we have shown that the system will remain trouble-free throughout its life if operated and maintained correctly.

Another commonly occurring problem that directly affects the installation of a system can be found at the design phase of a project. Early education and ongoing communication with design engineers can avoid most of those problems. To address the education component, we established a phased system design and product update series of lectures, usually at the designer's facility. We typically spend two hours per fortnight, over two months, dealing with individual aspects of the system. In some cases, we used real projects and assisted with the design, to bring home the advantages available. This has proven to be very successful as it allows the designer to specify the most efficient system possible using all the technology available.

By meeting with all project managers before contracts are awarded to demonstrate the appearance of all equipment and devices to be installed regardless of project size, we can avoid problems such as the placement and housing of fire alarm panels. Since amplifiers for a voice evacuation system can be housed in the fire alarm panels to centralise controls, these panels are somewhat larger than those of other systems.

No matter what system is being installed, some of the most common and time-consuming problems that occur on a project are found during the commissioning. Given the complicated scope of most installations, device addresses and locations can easily be recorded incorrectly, requiring the installer to backtrack the installation and cross-reference the addresses and locations. This process costs the installer both time and money.

EST systems overcome this problem for us since, unlike some other systems, these devices do not need to be addressed during installation. They are electronically addressed in such a way that the loop can determine the physical connection from device to device, mapping the devices to create an "as-built" drawing of the entire system at the control panel. In this way, we can easily check that the installation

Life Safety Systems

matches the information the installer has provided. As long as room spaces are properly identified, any deviations from the plans become obvious as soon as the system is activated and can then be easily rectified. If necessary, these devices can also be traced and identified through the individual serial numbers printed on them.

In many instances, mapping plans can be misplaced or quickly become out-of-date as devices are switched or replaced during maintenance. The electronic mapping, however, is always available at the control panel and is always up-to-date. If one device is replaced with another, the system readdresses the replacement device to correspond with the mapping sequence.

Earth faults, or ground faults, are another common installation problem detected during the commissioning of a fire alarm system. Correcting earth fault problems can require a great deal of time and human resources. The process of identifying the point of earth-fault contact in a loop is done through trial and error and often requires the investigation of wiring in places that are cramped or difficult to reach. Again, EST systems provide us with an advantage when dealing with

Pic: courtesy of Edwards International

this problem. Earth fault circuits in these systems are included at the module level rather than the loop level, resulting in shorter lengths of wiring to check, usually only a few hundred feet. Loop-level earth fault circuits can require possibly thousands of feet of wiring to be checked in order to find problems.

Electrical noise is yet another problem that is tied directly to installation procedures, though the problem does not usually present itself until the project is complete. This problem is in no way system-specific as it relates directly to the type of wiring that is installed. While many prefer to work with straight wire or mineral wire when installing fire alarm systems, twisted-pair wiring provides an electrical advantage for noise immunity. When a system is activated, twisted-pair wires can result in noise cancellation of as much as 80 dB over straight wires, creating a more efficient signal throughout the system.

As mentioned above, it is critical to maintain ongoing education and communication with those at all levels of the project chain. We have found this to be especially true when working with electricians in Ireland. With a traditional shortage of experienced engineers in this country's fire industry, it is common practice for the electrical contractor to install all but the internals of the control panel on new projects. This gives some of the electricians a lot of field experience on the equipment, sometimes more than the engineer. For this reason, we have found that it makes viable sense to hire an electrician with a high level of standard training as an employee, then provide further training as required on each system. Though this is commonly seen as a costly exercise in the industry, we have learned from experience that the result is a higher qualified and experienced electrician with understanding from both the fire industry and electrical worlds. This in turn produces a higher quality installation, and more effective understanding and relations between all parties when undertaking a project.

Earth faults, or ground faults, are another common installation problem detected during the commissioning of a fire alarm system. Correcting earth fault problems can require a great deal of time and human resources.

The end result in such situations is fewer installation and installation-related problems.

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35′	75 PSI	121 GPM	30 PSI	138 GPM	35 PSI	133 GPM
40′	75 PSI	121 GPM	40 PSI	159 GPM	45 PSI	150 GPM
45′ W/ 35′ STOR.	90 PSI*	133 GPM*	50 PSI	178 GPM	50 PSI	158 GPM
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* K.14 Must Include one row of in-rack sprinklers.

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Combustible Storage


Pic: courtesy of NFPA

By Ed Comeau and Robert Duval


Pic: courtesy of NFPA

Improperly stored oxidizers can pose a fire risk in warehouse occupancies

On August 2, 2000, Phoenix, Arizona, experienced one of the largest fires in its history in a multi-tenanted building containing Central Garden and Pet Supply and Cardinal Distributors. By the time fire crews extinguished the blaze the next day, the building was a smoldering ruin. A number of civilians had to be evacuated from the surrounding neighborhood, and the loss is estimated to be in the hundreds of millions of dollars.

What caused the fire to become so large? NFPA sent Senior Fire Investigator Robert Duval to Phoenix to find out. Investigation into the cause of the fire continues as of this writing.

THE FIRE DEPARTMENT

The 20-year-old building in which the fire started contained two occupancies separated by a concrete panel wall that extended from the floor of the building to the underside of its roof deck. On one side of the wall, with multiple fire door penetrations, was a home and garden supply warehouse containing a variety of products and commodities. On the other was a pharmaceutical supply warehouse.

The main portion of the building measured 400 feet (122 meters) by 208 feet (63 meters). The section occupied by the home and garden supply operation measured 220 feet (67 meters) by 208 feet (63.4 meters), and the pharmaceutical distribution area was 180 feet (55 meters) by 208 feet (63.4 meters). The building, which would be classified as a storage occupancy by the 2000 edition of NFPA 101®, Life Safety Code®, also had an office wing 105 feet (32 meters) long and 30 feet (9 meters) wide.

The exterior walls of the warehouse had no windows, though the office wing did. Overhead doors through which stock was loaded and unloaded were on the east side of the building.

The structure's roof assembly consisted of a $^{1}/_{2}$-inch (1.3-centimeter) plywood deck covered with many layers of mopped asphalt and supported by 10-by-4-inch (25-by-10-centimeter) purlins supported by engineered laminated beams. The beams were supported by steel columns 5 inches (13 centimeters) in diameter on a 40-by-23-foot (12.2-by-7-meter) spacing. In the warehouse, the ceiling was 30 feet (9 meters) high.

The exterior walls were tilt-up concrete panels, 6 inches (15 centimeters) thick, attached to the concrete floor slab with threaded connections.

The building was equipped with an automatic fire sprinkler system. The pharmaceutical warehouse and home and garden supply warehouse had ceiling-level systems with .495 gpm/feet^2 over 2,000 square feet (186 square meters) with sprinklers rated at 286°F (141°C) with orifices $^{17}/_{32}$ inch. There were no in-rack sprinklers.

BUILDING CONTENTS

Because the warehouse supplied area home improvement stores, the products offered varied significantly, from bird feeders and tools to redwood products and batteries. Also among the materials were fertilizers, insecticides, and pesticides. They were stored in different configurations, on double and single-row racks, and in solid piles 10 to 20 feet (3 to 6 meters) high. The solid- and open-shelf configurations were 20 feet (6 meters) high, separated by aisles 8 to 10 feet (2 to 3 meters) wide.

Many items were stored in corrugated cartons scattered throughout the warehouse wherever space allowed. Some pallets were encapsulated in plastic sheathing.

Chlorinated pool chemicals, which are oxidizers, and are addressed in NFPA 430, Storage of Liquid and Solid Oxidizers, were also stored in the warehouse. While not combustible themselves, oxidizers can significantly increase the intensity with which other products burn. Furthermore, they're incompatible with other products that may be stored in home and garden occupancies.

Oxidizers are divided into four classes based on the inherent hazards they present. Class 1 oxidizers increase the burning rate of other products slightly. Class 2 oxidizers moderately increase the burning rate and can cause spontaneous ignition. Class 3 oxidizers severely increase the burning rate of other products, can cause spontaneous combustion, and will undergo self-sustained decomposition. And Class 4 oxidizers severely increase the burning rate of other products, can cause spontaneous combustion, will undergo self-sustained decomposition, and will cause an explosive reaction.

When contaminated with incompatible products, oxidizers can cause spontaneous

4424 South 38th Place, Phoenix, AZ
August 2, 2000
4:58 p.m. Alarm received
5:01 p.m. Command established; report of heavy fire showing
5:02 p.m. Command orders a defensive operation; Engine 23 on the scene
5:02 p.m. Several explosions reported
5:03 p.m. Second alarm called
5:04 p.m. Deck gun and large hand lines in operation
5:05 p.m. Engine 272 ordered to set up at the northeast corner of the building and use the Telesquirt
5:07 p.m. Police department reports that one building contains cyanide
5:11 p.m. Third alarm called
5:14 p.m. Structural collapse on west side with explosions; additional collapse at the southwest corner of the building
5:17 p.m. Several more explosions reported
5:18 p.m. Personnel pulled back from east sector
5:18 p.m. Safety sector reports that the building is intact, but leaning on the west side
5:23 p.m. Fourth alarm called
5:25 p.m. Wall on west side collapses
5:29 p.m. Personnel ordered to don SCBAs
6:10 p.m. Engine 23 personnel transported to hospital
6:18 p.m. Police helicopter begins aerial reconnaissance
6:21 p.m. Responsible party for the fire building is on the scene
6:44 p.m. Fire is reported moving north through the building
7:26 p.m. Fire is reported showing in the other half of the building
7:43 p.m. Foam 3 from airport is on the scene
August 3
9:04 p.m. Incident closed

combustion. If the heat of combustion is confined, nearby combustibles may ignite. To suppress fires involving oxidizers, large amounts of water may be required. Small amounts of water can cause oxidizers to react and release chlorine gas.

THE FIRE

On the day of the fire, employees reported an unusually strong chlorine odor in the home and garden supply side of the warehouse. Chlorine could often be smelled in that area because many of the products stored there contained the chemical, but this was worse than usual. To identify the source, the employees moved pallets of the pool chemicals outside and opened several large overhead doors to help ventilate the building. At 11:30 a.m., the chemicals were moved back into the building, but the chlorine odor became strong again, so all of the pace tri-chlorine in 35-pound (16-kilogram) plastic buckets and some pace tri-chlorine in 75-pound (34-kilogram) fiber drums were taken outside to the east side of the building. None of the cal-hypo or pool shock was removed from the building. The workday ended before workers discovered the source of the odor.

Less than an hour later, pharmaceutical supply company employees on the other side of the building reported hearing a rumbling noise. Some thought it was a thunderstorm and went outside to look. When they did, they could see smoke coming from the other side of the building.

Driving along the nearby freeway, a deputy chief from the Tempe, Arizona, Fire Department also saw the large column of smoke and immediately reported it to the Phoenix Fire Department. He then drove toward the smoke to find the source. At about the same time, Fire Station 23, located near the warehouse, also began responding after a civilian notified crews of the blaze. The sheriff's department was also notified by two sheriffs, who saw the column of smoke.

The Tempe chief arrived on the scene at 5:01 p.m., assumed command, and reported a working fire in the warehouse. Shortly after, Engine 23 arrived and positioned itself at the southeast corner of the building after connecting to a nearby hydrant. Because the fire was so intense, firefighters immediately began applying water using an engine deluge gun.

At this point, the fire was well involved, and fire crews reported that the overhead doors were beginning to buckle and that the fire's thermal column was lofting debris into the air. Crews noted that breathing apparatus was unnecessary because the smoke was going straight up but the smoke came back down and firefighters on Engine 23 were sent to the hospital and treated for smoke inhalation.

As the fire grew, flames ignited contents of the exterior storage area, so firefighters advanced hand lines in an attempt to control these fires.

At 5:03 p.m., the incident commander issued a second alarm. The Phoenix Fire Department, which comprises 52 stations spread out across 480 square miles (1,243 square kilometers), is part of an automatic aid system that includes 19 other cities. Two minutes after the second alarm was called, Engine 272 arrived from Tempe and began applying water using its telescoping water tower.

At 5:07 p.m. Engine, Rescue, and Ladder 22 arrived and were positioned on the west side of the building. The crews reported that the tilt-slab walls were leaning outward and that there was a significant danger of collapse.

The incident was upgraded to a third alarm at 5:11 p.m.

At 5:17 p.m., a section of the tilt-slab walls in the southwest corner of the building began to collapse, pulling other sections along with it. Aerosol cans began to rocket out of the building towards firefighters. The crew from Ladder 22 reported hearing several cans strike their apparatus.

To protect them from the potentially lethal effects of the burning chemicals, all personnel were ordered to don self-contained breathing apparatus at 5:29 p.m., and civilians in the area were evacuated. In addition, the nearby freeway and local roads were closed. Firefighters on the scene had to be decontaminated because of their contact with the smoke.

THE AFTERMATH

Following the fire, five firefighters suffering from the effects of smoke inhalation and extreme heat—on the day of the fire, the temperature-hit 100°F (38°C)—were hospitalized for observation. According to the Arizona Department of Health Services (ADHS), 10 area residents also sought treatment at local hospitals.

ADHS took several air and dust samples from the fire scene and from residences downwind of the fire. No significant pesticide depositions were found in any of the homes.

Fire department investigators, trying to

Pic: courtesy of NFPA

determine the cause of the fire, were hampered by the heat, which was normal for Phoenix at that time of year. They had to work early in the morning, before it became too hot to operate. To add to their discomfort, they had to wear hazardous materials suits and breathing apparatus to protect them from the hazardous materials stored in the warehouse.

Investigators still haven't determined the cause of the fire, but they theorize that one of the stored commodities, such as the pool chemicals, played a significant role in the spread of the fire.

Based on this and other fire investigations and analysis, NFPA has determined that the following factors may contribute to large loss in similar facilities, including lack of segregation between incompatible materials, such as oxidizers and hydrocarbon based materials, lack of proper storage configuration for oxidizers, and inadequate sprinkler protection for commodities in a warehouse.

This wasn't the Phoenix Fire Department's first fire involving pool chemicals. In 1988, a warehouse containing pool chemicals in the neighboring city of Glendale caught fire, and the resulting conflagration required a major suppression effort.

Fire departments in other areas of the country have also had to deal with fires involving pool chemicals in big-box stores. In 1995, a fire broke out in a Home Depot in Quincy, Massachusetts, when pool chemicals came into contact with petroleum products. In 1996, a fire occurred at a home improvement store in Albany, Georgia, also in the area where pool chemicals were stored.

Pic: courtesy of NFPA

SAME CHEMICALS, DIFFERENT TOWNS

The Quincy fire started at 8:23 p.m. on May 23, 1995 when the building was occupied by 60 employees and 100 customers.

The single-story building, which was of noncombustible construction, covered 122,395 square feet (11,371 square meters) and was equipped with a fire alarm and sprinkler system. The display merchandise and bulk products were stored throughout the building on a metal double-rack system.

The Quincy Fire Department and the Massachusetts State Fire Marshal's Office determined that the fire, which started in the lower storage rack in an area in which pool chemicals were stored, was probably the result of a chemical reaction involving the pool chemicals and motor oil leaking from boxes containing lawn mowers.

NFPA's investigation and analysis of this fire revealed several factors that contributed to the loss of property. Incompatible materials were stored too close to the oxidizing pool chemicals. Products on the racks were piled higher than the allowable storage heights and within 18 inches (46 centimeters) of the sprinklers. The sprinkler design was inadequate to protect encapsulated materials, and there were no in-rack sprinklers. Rack shelving of solid materials and wooden slats were too close together. And products were stored in the aisles, reducing clearance between products on adjacent racks.

The store's sprinkler system and the fire department confined the fire to a small area. However, many products in the store were smoke-damaged and had to be replaced. The building's fire alarm system was also replaced because of the potentially corrosive action of the smoke.

The 1996 Albany incident had a dramatically different outcome than the Quincy incident. Fire personnel reported structural failure within minutes of arrival, even though the building was sprinklered, and the building was destroyed.

The fire began around 11:21 a.m. on April 16, 1996 in a fully sprinklered Lowe's and destroyed the building and its contents, resulting in an estimated loss of $9 million. Arriving firefighters found the fire beginning to vent through the roof and through an area where the walls had begun to separate. Despite their efforts, the fire grew rapidly, spreading through the entire building.

The store sold home improvement products, including lumber, plumbing and electrical supplies, tools, garden supplies, and pool chemicals.

The three-year-old, single-story, noncombustible building, which covered 85,000 square feet (7,900 square meters), was protected by three wet-pipe sprinkler systems. A dry-pipe system protected the garden center. Portable dry chemical fire extinguishers, manual fire alarm boxes, and a fire alarm system were also installed, and staff members had been trained to respond to fire.

Although fire department investigators couldn't determine the cause, they established that the fire began near a rack containing pool chemicals and spread through the entire rack. The fire produced large amounts of irritating smoke, causing conditions to deteriorate rapidly.

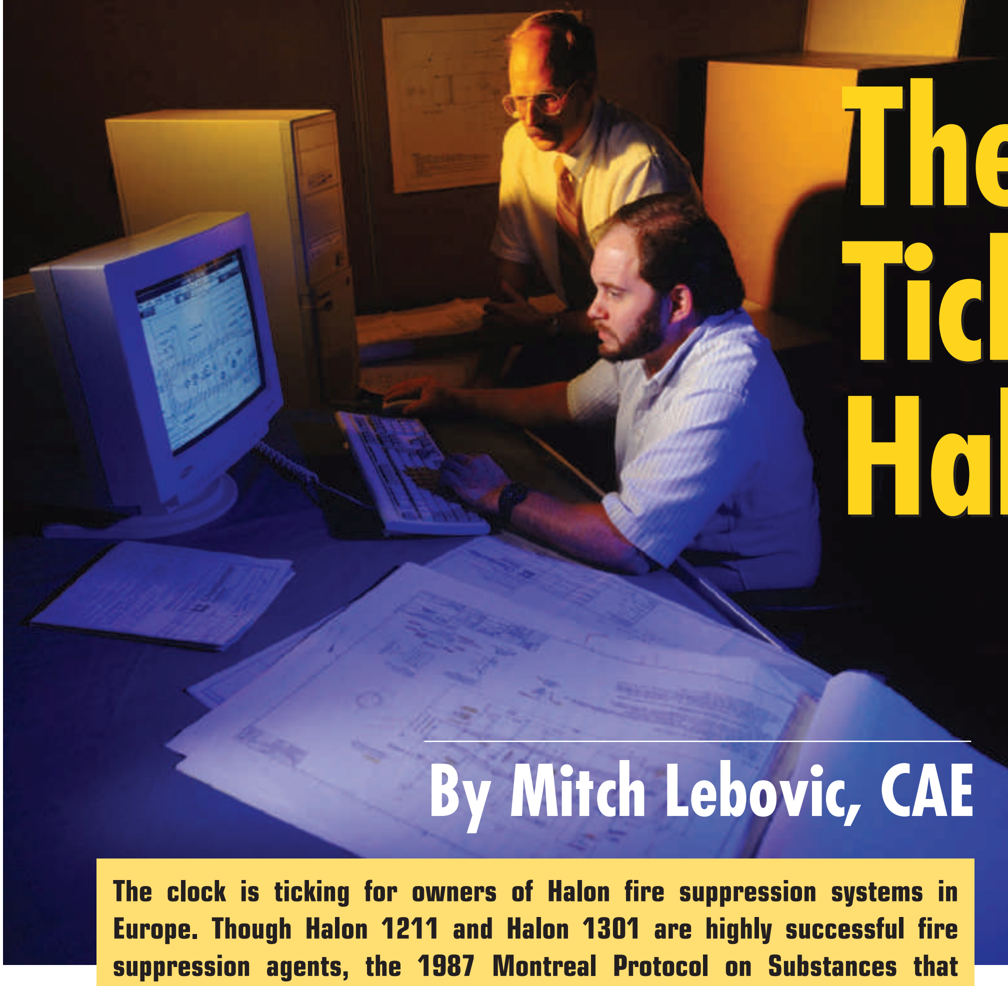
About 100 employees and 85 customers in the store at the time of the fire were evacuated before firefighters arrived.

The fire quickly overwhelmed the building's sprinkler systems, and fire conditions prevented firefighters from performing interior attacks. As a result, the blaze spread from one end of the building to the other, causing the roof to collapse. The building's contents were consumed.

NFPA's investigation revealed deviations from NFPA code requirements that contributed to the severity of the fire and to the loss of property. The oxidizers had been stored on racks that were higher and deeper than the limits imposed on retail storage. There were no solid, noncombustible vertical barriers between the oxidizers and incompatible materials, and the oxidizer storage area had no in-rack sprinklers. In addition, the store's sprinkler systems discharge densities and areas of operation were below NFPA code requirements for oxidizer storage.

Given their recent track record, oxidizers in the form of pool chemicals are an obvious cause for concern. It's important that they be stored properly, segregated from incompatible substances, and properly protected. It's also important that fire service personnel responding to a fire in an occupancy containing these products be prepared to take aggressive action to contain or control the fire.

Ed Comeau is the principal writer for writer-tech.com, a technical writing firm. He is NFPA's former chief fire investigator, and was a fire protection engineer for the Phoenix Fire Department. Robert Duval is NFPA's senior fire investigator.



The Clock is Ticking for Halon

By Mitch Lebovic, CAE

The clock is ticking for owners of Halon fire suppression systems in Europe. Though Halon 1211 and Halon 1301 are highly successful fire suppression agents, the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer identifies Halon as a potential ozone depleter. The production of new Halon was banned in 1994, and the European Community laid out a plan to dispose of all Halon being used in non-critical applications.

EC REGULATION 2037/2000 sets dates for decommissioning these Halon systems. It prohibits the sale of Halon after December 31, 2002 and requires that all non-critical Halon systems be decommissioned by December 31, 2003.

WHO IS IMPACTED?

Annex VII of EC Regulation 2037/2000 defines the following as critical uses for which Halon 1301 will be permitted beyond 2003:

- In aircraft for the protection of crew compartments, engine nacelles, cargo bays and dry bays.
- In military land vehicles and naval vessels for the protection of spaces occupied by personnel and engine compartments.
- For the making inert of occupied spaces where flammable liquid and/or gas release could occur in the military and oil, gas and petrochemical sector, and in existing cargo ships.
- For the making inert of existing manned communication and command centers of the armed forces or others essential for national security.
- For the making inert of spaces where there may be a risk of dispersion of radioactive matter.

Annex VII also permits the following uses for Halon 1211.

- In hand-held fire extinguishers and fixed extinguishers for use on board aircraft.
- Fire extinguishers essential to personal safety used for initial extinguishing by fire brigades.
- In military and police fire extinguishers for use on person.

If your Halon system or extinguishers are not used for one of these purposes, the regulation applies to you.

BACK TO THE DRAWING BOARD

If you're a non-critical Halon user, experts recommend using this opportunity to reassess the nature of the hazard. The fact that Halon was originally used to protect it does not necessarily mean a clean agent is the best solution to replace Halon. Also, companies faced with multiple Halon systems might have to prioritize.

"Halon was often used in hazards where other types of suppression would have worked," says Shawn Mullen, executive vice president of Protex Central, Inc. in Des Moines, Iowa. "In some cases, dry chemical, foam or carbon dioxide might be viable replacement agents."

The reassessment process starts by determining the critical nature of the hazard. Can the items be replaced? Can you afford down time caused by fire damage or clean up? Are there redundant systems. Can you still operate if the system goes down?

Though you probably asked those questions when you installed the Halon system, the mandated 2003 decommissioning deadline may force you to ask them again relative to other hazards you're protecting.

Once you've determined the hazard merits continued protection, determine its nature. Is it electrical in nature? Is it flammable liquids? Dry document storage? Then, look at the structure. Finally, look at operational issues. Is the room normally occupied? The answers to these questions will determine the proper replacement system.

Other factors influencing the Halon alternative include the ability to reuse elements of the existing system.

"Look at the control and delivery systems," says Mullen. "Are there elements of the existing piping systems that can be reused? Is the control system compatible with and approved for use with the system to which they're going to convert? Can existing conduit be reused? What about the existing power supply?"

"The thing that really drives this process, however, is going back to making an assessment of what you're protecting," Mullen continued. "Once that is defined, then you can methodically make your determination of the best agent for the hazard and how the existing system might be adapted to it."

CLEAN AGENT ALTERNATIVES

Following the Montreal Protocol, members of the fire protection community

Pic: courtesy of FSSA

worked closely with government and environmental organizations to develop substitute agents that would extinguish fire effectively without harming the environment. To date, the next generation of clean agents consists of five commercially available products developed in compliance with environmental regulations. While other agents have been produced, those with the greatest market acceptance are Argon, FE-13, FM-200, FE-227 and INERGEN.

Halocarbon agents, such as FE13, FM-200 and FE227, absorb heat from the fire to the point where combustion can no longer occur. Inert gas agents, such as INERGEN and Argon, lower the hazard's oxygen content below the level necessary for combustion. Each of these agents shares Halon's quick suppression characteristic. Like Halon, they are also "clean" agents, which means they are non-conductive and non-corrosive. There is no residue to clean up, no lingering materials to slowly degrade equipment and no need for an expensive disaster recovery process. At fire suppressing concentrations, these agents are safe to use in occupied areas.

THE RIGHT ALTERNATIVE

The right Halon alternative depends on the nature of the application. "The best agent varies based on several factors," says George Krabbe, chairman of the board of Automatic Fire Control in South Holland, Ill. "If the customer doesn't have a lot of room, he's not going to pick an agent that requires more storage space. Some agents work better at lower temperatures and some are stronger in high bay areas."

Krabbe suggests that a visit with a fire protection expert is the best way to make the right choice for a specific application.

HALON DISPOSAL

When it's time to dispose of your Halon, you can make it available to critical users through recycling organizations. In Europe, you can find credible Halon recyclers through the Halon Users National Consortium at www.hunc.org. In the United States, contact the Halon Alternatives Research Corporation at www.harc.org.

In some cases, fire protection distributors will purchase unused Halon to resell to customers who still have Halon Systems. Also, U.S. Halon users have the option of donating unused Halon to the Department of Defense Ozone Depleting Substances Reserve.

Remember, Halon must be disposed of in accordance with environmental regulations.

DECOMMISSIONING RESOURCES

Here are two helpful resources to walk you through the decommissioning process. First is a document titled *Registered Scheme for Halon Decommissioning* published by British Approvals for Fire Equipment. It can be found on the BFPSA web site at www.bfpsa.org.uk. The second is the *Safety Guide for*

Decommissioning Halon Systems available from www.harc.org.

START PLANNING TODAY

Given the December 2003 deadline, now is the time to begin planning the transition.

"Involve as many people as you can to come up with the best solution," advises Mullen. "Get input from everyone involved with the hazard, from the people who have to maintain the system to the people responsible for the process the system protects."

"You can't simply drop in a new agent and many of these applications are critical," adds Krabbe. " The end user can't just shut down for a month so the Halon 1301 system can be replaced."

The replacement process will take months. Once a final decision has been made regarding the type of system, engineered drawings need to be developed, approval processes must be followed and the system itself must be fabricated, delivered, installed and tested. Though the deadline is still nearly two years away, planning now allows for responsible budgeting. It also provides a contingency plan should the system discharge and require recharge after the 2002 ban on Halon sales.

WHAT ABOUT NON-EUROPEAN USERS?

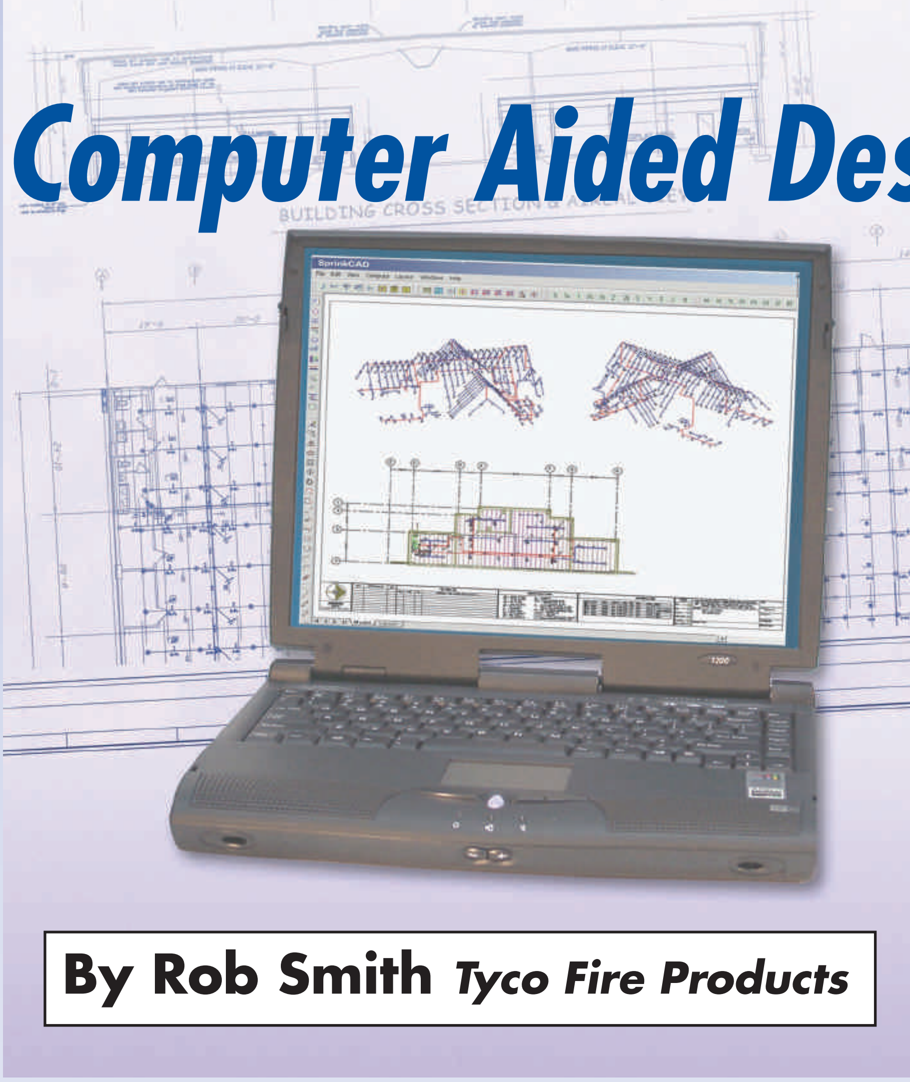
In the United States, there is no current legal obligation to remove Halon systems from service. Also, there is no federal legal requirement to remove systems from service by any specific date. In order to minimize Halon emissions, the Environmental Protection Agency strongly encourages Halon users to explore non-ozone depleting alternatives. However, this has not been mandated.

Australia has developed a response to the Montreal Protocol as well. The 27-page *Australian Halon Management Strategy* can be downloaded from www.ea.gov.au. This strategy provides a framework for the responsible management of Australia's Halon stocks to 2030 and the ultimate elimination of their use.

Japan's National Halon Management Strategy can be downloaded from www.env.go.jp. No new Halon installations are permitted in this country. Beyond that, other Asian countries have yet to develop high-level regulations regarding Halon.

MITCH LEBOVIC, CAE,
is director of communications for the Fire Suppression Systems Association in Baltimore, Md. You can visit FSSA online at www.fssa.net

Pic: courtesy of FSSA



Computer Aided Design (CAD) in the Sprinkler Industry

By Rob Smith *Tyco Fire Products*

CAD-BASED SOFTWARE for the sprinkler industry has become so advanced that it is possible for simple commands to:

- Generate trees, grids, and loops sized and spaced to fill a bay or an entire structure;
- Select the correct sprinkler technology for any of a number of highly specialized design approaches;
- Have the head spacing determined automatically by the placement of structural members and limited by the listing criteria of the sprinkler head selected;
- Automatically determine pipe sizing based on the available water source curve;
- Generate completed calculation reports followed by stock list reports with pricing;
- Have all the pertinent data dropped into the AutoCad environment with cut-lengths, hydraulic reference nodes, and fabrication tags attached!

The modern CAD designer, using high-end software such as SprinkCAD™, HydraCad™, and AutoSprink™, to name a few, has a mechanic's toolbox of commands at his or her fingertips that go far beyond the capabilities of CAD alone. But it was not always so.

I don't personally recall when schedule 40/30 pipes were about the only pipe in use. When you would rather hang two runs three hundred feet long than have to screw any ten-inch pipe because screwing eight inch was hard enough. Chances are you don't remember those days either, but I heard all about it from my Dad. He told me how they did it before grooved couplings, how they used chain tongs and come-alongs to screw eight inch threaded pipe. How it took two men climbing A-frame ladders in tandem with a length of six-inch pipe on their shoulders to get twenty feet of main into the air. Installation practices have changed drastically over the last thirty years, and so has engineering.

I remember lead holders, sandpaper boards, and Borco brand board covering. I never used linen sheets and fountain pens, but I've seen them. Engineering media improved from linen to vellum, mylar, and bond. From pens in our hands we've gone to lead holders, mechanical pencils, plastic leads, technical pens, and finally to plotters.

Now computer-based engineering is the norm, when it was once a novelty – an expensive novelty, at that. But with computer costs coming down and speeds going up, with designers coming out of school with AutoCad® experience, and with software improving at ever-increasing speeds, the computer desk is quickly replacing the drawing board.

Computers first made their entry into the design department with hydraulic calculations. I was lucky enough to have learned hand-calculations before I even knew what a Personal Computer was, and then came programmable calculators to speed up the process. Many of us used the Texas Instruments calculator with the tape reader function, replaced by the programmable Hewlett Packard's, but soon everyone was sitting down at a computer to run their hydraulics. Computer Aided Design, or CAD, has made the same rapid improvements.

Many designers have used AutoCad® and other CAD programs as a drafting tool without the benefit of add-on packages tailored to our industry. Some created extensive libraries of blocks and details to speed their work. This ability of CAD programs to recall previously drawn drawings, details, and blocks was one of the original reasons some chose to draw in CAD.

I was always fascinated with the novelty of drawing plans on a computer, though I did not blaze any trails. The

first system I was exposed to was not run on a PC, was not AutoCad®, and wasn't really particularly effective by today's standards, but I didn't know any of that. I just wanted to learn it, use it, and get rid of my technical pens and electric eraser. This was somewhere between the busy days of the hospital/nursing home retrofits and the busier days of the high-rise retrofits in Los Angeles. It wasn't really my choice to learn CAD; I was lucky enough to be asked to learn it. I really appreciated the ability to make changes without an eraser! Simple as that sounds, it was a wonderful thing. I loved the ability to reuse backbone layouts on floor after floor of tenant revision plans without having to work on sepia or bond copies. Working in CAD always gave you clear, clean drawings. And anyone who has grown tired of drawing circle after circle of sprinkler head symbols knows the utter joy of using the ARRAY command! But the real advances in CAD for the sprinkler industry run much deeper than just drafting techniques.

There has been a steadily growing need to have some CAD design capabilities in-house for most companies. The driving factors though, have mostly been external. The architectural community led the way to CAD, and has been dragging all the trades in that direction for years. From compressed schedules came the need for cooperative design. This drove architectural firms to CAD, where teams of personnel could design multiple phases of a project simultaneously, utilizing features like X-Referencing and View ports. Soon drawings were being made available to the trades in the AutoCad® DWG format, theoretically saving the time of generating backgrounds for our work. I say "theoretically" because I have vivid memories of swearing I could have drawn the background faster with a broken pencil than it was taking me to "clean up" an architect's drawing for my use. I learned a lot about paper space, x-referencing, and nested blocks in those days simply because I had to. I suppose I should thank (and apologize to) those nameless individuals who forced me to learn some basic, valuable tools (while cursing their names).

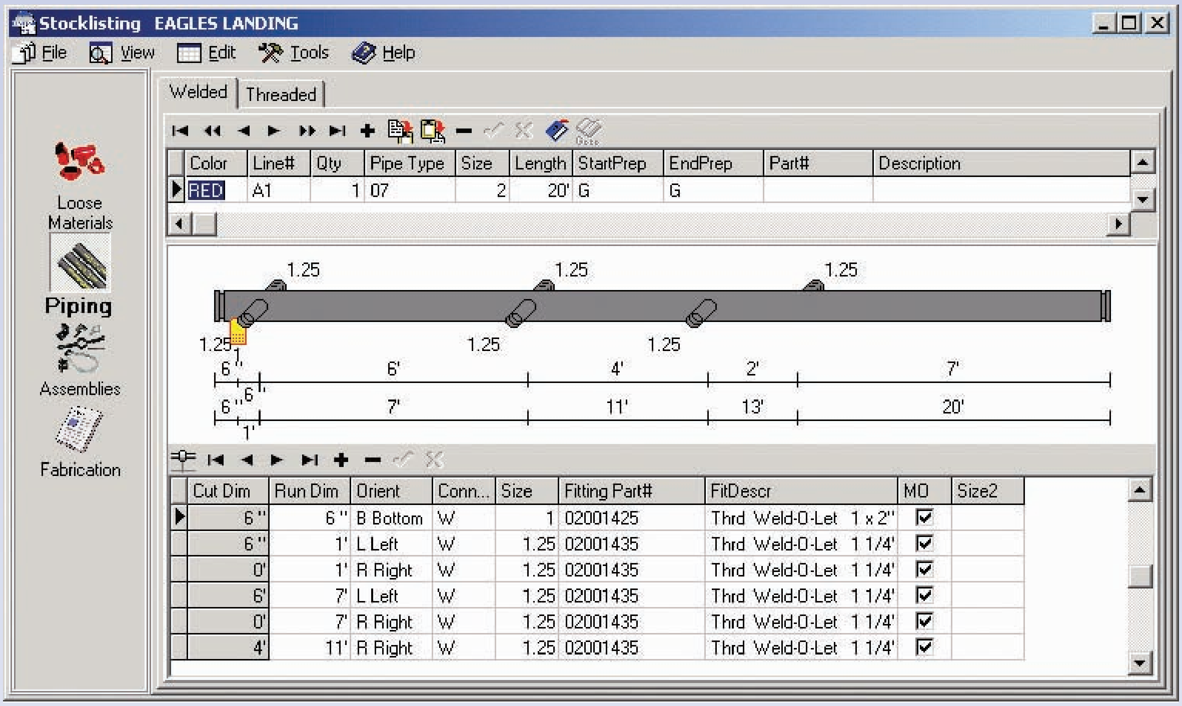


Image: courtesy of Tyco Fire Products

As drawings became more widely available on disk, the push for CAD hit the mechanical trades. Not only because the backgrounds were now available for immediate use by the mechanical designer, but also because the originators of those backgrounds wanted a return on investment: Mechanical as-builts in electronic format. The requirement for the mechanical trades' drawings to be submitted in DWG format at the end of the project was suddenly widespread. I remember projects where the need to deliver materials quickly to the job site precluded drawing those plans in CAD. We didn't have enough CAD-based designers. But the requirement to turn over record drawings in DWG format put us between a rock and a hard place. We were forced to draw in teams, "on the board", and then have someone transcribe our plans into AutoCad. All this extra work because the design department was not up to speed on CAD.

Later, with another company, I was fortunate to work on a project where the trades collaborated using electronic documents for schedules and drawings. It was my first experience with this new level of inter-trade communication facilitated by the use of CAD systems. The architects and engineers, the general contractor, and all the on-site trades shared information, in DWG format, for coordination and scheduling. I recall a small commotion early in the process when our placements for (concrete wall penetration) sleeves were found to be consistently in conflict with the plumber's chosen locations. They had selected their locations, passed the drawings to us, and then our sleeves were placed in direct conflict with theirs. We had no idea we were setting our sleeves where they had already proposed theirs. The drawings they passed to us seemed to be lacking any needed penetrations because their designers were drawing on a white background, using a line color very near black! We drew on a black background (still my preference), so we settled on some standard line colors that would be visible to all and continued in peace.

These days it is not so unusual to perform coordination tasks by sending copies of your plans to the other trades. The old practice of traveling to the site one a week to do "overlays" on a light table is made unnecessary using CAD. Online sharing of information is now the new frontier, where you can view and interact with the work of another designer without actually receiving his "intellectual property". This streamlines the dissemination of information, and keeps old information

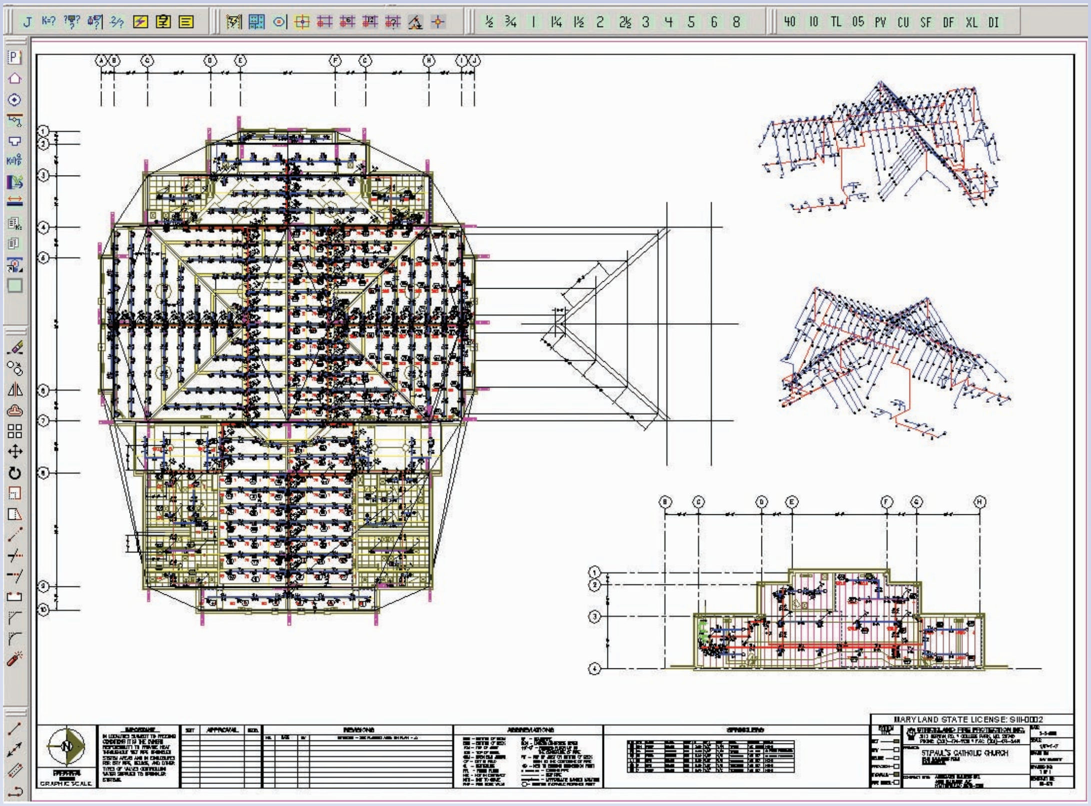


Image: courtesy of Tyco Fire Products

out of circulation, a common problem in the not-so-distant past.

The pioneers in CAD programs for the Fire Sprinkler industry have always tried to deliver more than just a computerized drafting program. Stock listing, hydraulic calculations, job estimating, and inventory control have been strived for from the very beginning. It is in fact these abilities, and the advancements in these abilities, that have truly made CAD engineering packages a necessity for any design department today.

Hydraulic calculations require an accurate model of the pipe lengths, pipe diameters, and fitting arrangements in the calculated areas and the supply piping. In gridded systems, this means the entire system needs to be accurately modeled. The integration of CAD design and hydraulics was a natural progression. Now some programs can locate the Most Hydraulically Remote area for the user, determine the correct number of flowing nodes for that area, and place the nodes on the plan for the user, all by launching a single command.

Stock listing of the system dovetails nicely into the same requirements for effective hydraulic calculations. Once the system is modeled in CAD for the hydraulic calculations, the user is literally seconds away from generating a complete stock list with threaded and welded fabrication reports tapered to the wants of the fabricator. Identification of sprinkler heads acceptable to the design parameters of a project is automated in some systems as well. With modern programs, the CAD drawing is linked to a database of industry-standard parts, so that any design flaws that would necessitate the use of unknown or little-used fittings creates error messages alerting the designer to the possible problem.

These same databases provide data for the correct calculation of a system, utilizing K-factors and listed pressure requirements, then pass other data to the stock listing modules, providing thread size for the associated fittings, and temperature rating, orientation, and finish for the loose materials list. Entire purchase orders are virtually filled out by the processing of the drawing through these stock list generators. With recent advances in communication between supplier and contractor, entire orders for materials and fabrication are now traveling across the Internet to put pipe on the job tomorrow.

These advances will not replace the sprinkler designer, but will certainly make the transition from green recruit to productive designer easier and faster.

The need for conscientious application of knowledge and experience can never be overlooked in a design department, not without the possibility of tragic consequence close on the horizon. But even in the area of code interpretation, the sprinkler software industry has responded to the call.

Where will we go from here? That's beyond my purview, but I don't see the advances stopping now. I've long had a vision of what we may one day see in terms of hardware, though, and with the new flat panel monitors, touch-screen systems, and voice recognition software, we may not be far off. I see a drawing board sized monitor, much like a digitizer, with a stylus like a pencil. You speak commands to the software. "Zoom", "Pan", "Draw main".

The picture I get reminds me of an engineer on a tall stool at his board, drawing sprinklers. Reminds me of where I started. Maybe someday we will come full circle, but with the power of software today and the promise of the future, it will be much more enjoyable working at that drawing board.

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Water Mist for Industrial Hazards

By Dirk K. Sprakel
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TO COMPLY WITH LEGAL ENVIRONMENTAL POLICIES, halon-extinguishing systems must be replaced by alternative fire fighting techniques on a world-wide scale. Most of the European countries are bound to dispose of their remaining halon systems in the very near future. However many industrial users, still have to decide which type of fire fighting technique they should adopt to replace their existing halon systems.

The problem has again and again been dealt with in technical publications and conferences during the last few years. The most diverging ideas and opinions were discussed on those occasions, sometimes rather controversially. It was, after all, a challenge to find a substitute for a particularly effective extinguishing gas whilst at the same time taking into account, protection of lives and the environment. Water mist as a fire-fighting medium, was regarded as exotic when the discussions about the banning of halon began, has continuously gained importance over the past few years.[1] One of the causes of this trend has certainly been the fact that water mist systems are a suitable option for both sprinkler applications (fire control) and gas applications (extinguishment). This article plans to show which industrial applications water mist is best suited and why it's superior to other fire fighting media in many cases.

Extinguishing gases as an alternative halon substitute

It would of course make sense to substitute halon by another environmentally friendly extinguishing gas. Therefore, in response to the banning of halon, various gases were developed which are a direct alternative to water mist for a variety of applications. However, such gases are not in all instances the best solution from the user's point of view. The already wide spread extinguishing gases on a halocarbon basis (FM 200, FE 36, Halotron etc,) will in contact with fire generate corrosive gases[2] which are undesirable particularly in areas where electrical and electronic components are used. This applies especially to the IT applications, because the corrosive gases may cause damage to sensitive electronic components in the server cabinets (etc). British insurance companies recommend for this reason not to use such synthetic extinguishing gases in IT applications.[3] Besides, these halocarbonates may generate partially dangerous by-products. So an investigation carried out by the British Loss Prevention Council as early as 1996 showed that all commercially available halocarbonate-extinguishing gases used in the burning tests generated hydrogen fluoride.[4]

The widely used extinguishing gas CO_2 is well known for the hazards it implies for life safety, and is meanwhile looked at more critically under environmental aspects.[5]

Inert extinguishing gases, in contrast, are an environmentally acceptable alternative.

However, in most cases, the quantities needed are rather large so that special considerations are required when looking at storage areas for cylinders.

For all extinguishing gases, it is an essential prerequisite in their effectiveness that space integrity is complete and that a pre-warning time for evacuating any persons present must be observed. But such a pre-warning time, in principle, is equivalent to a 'pre-burning time' which is not in the user's interest and is counter productive when seeking rapid fire fighting.

Water mist systems, on the other hand, do not, in most cases, require a high degree of room integrity nor a pre-warning time.

Water mist as an established extinguishing technique

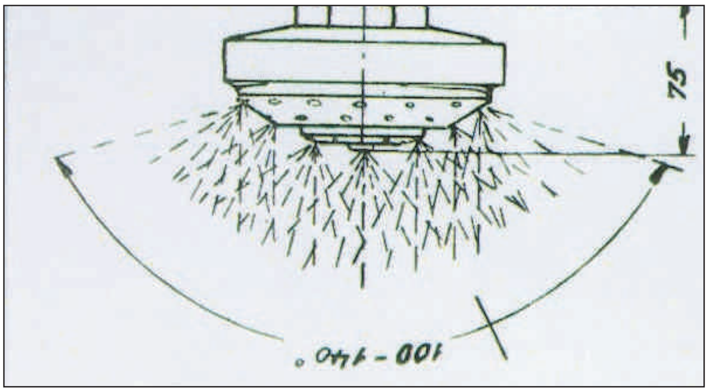
These disadvantages are avoided by using water mist. Considering the fact that water is the oldest extinguishing agent in

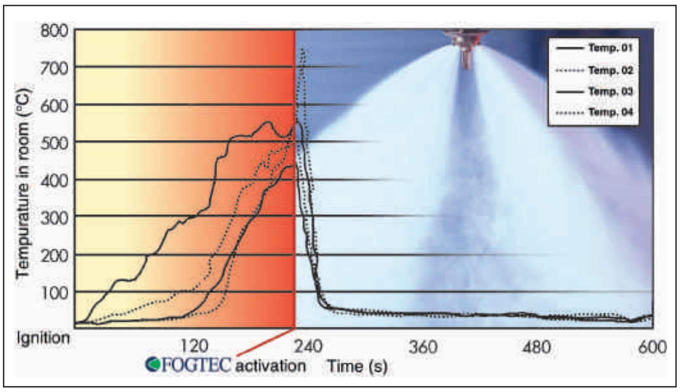
Fogtec Systems cause no damage to the environment.

the world – at the same time being a basic element of every ecological system – there is little point in discussing any negative side effects on the environment. It has often been considered whether this environmentally pleasant technology would be apt to produce similarly good results in fire fighting as some evidently more dangerous and detrimental extinguishing techniques. Today this question is not only answered in the affirmative for many applications, but a large number of investigations has shown that the protection of many risks is even more effective with water mist technology. Nevertheless, it is necessary – as for any other type of extinguishing agent – to examine the suitability of water mist for the specific risk to be protected. It is evident that even water mist cannot be the solution for all problems of fire protection, but the range of application has been growing with tremendous speed over the last few years.

The surprising aspect is that this development has been initiated only by the

Pic: courtesy of Lechler





Stationary watermist nozzle from 1938. Courtesy of Lechler

Temperature during a full scale fire test.

banning of halon. This is even more surprising when you consider the fundamental technology is not new. As early as 1937 the Lechler company (Germany) became active in marketing water mist systems for mobile and stationary applications. Also the Food Machinery Corporation (USA) and Myers (USA) offered such systems in the thirties and forties. At that time they were obviously lacking the technology required to produce commercially attractive and at the same time effective systems for marketing on a wide scale. Only in the late seventies, the idea of fire fighting with water mist was revived in the countries of the former Eastern Block, in particular in Russia and the German Democratic Republic, thus creating the basis for the present state of technology.

Today nearly all internationally relevant, directive-issuing institutions and research organizations are devoted to the topic of water mist technology. Among them number Factory Mutual, Allianz, NFPA, International Maritime Organisation, US Coast Guard, CEN, DIN, SINTEF, SP, VTT, Experts gather regularly under the roof of the International Water Mist Association (IWMA). This organisations first directives were for the installation, design and approval of water mist extinguishing systems.[6] Other directives are under preparation.[7]

Thus prospective users of water mist technology are, in most cases, provided with an adequate basis for a competent protection of their specific risks. This is also reflected by the fact that an enormous number of water mist installations have been carried out over most continents.

System types

Water mist systems are offered as so-called low-pressure (LPWM) and high-pressure (HPWM) water mist systems. Both types use the same sufficiently well known basic principle, i.e. they generate small-sized water mist droplets that are used for cooling and oxygen displacement by water vapour generation. The types differ from each other in respect of the working pressure applied. High-pressure systems normally require considerably less water than low-pressure systems, thus being more effective, but due to the higher pressure they need a more specific technology. Both HPWM and LPWM systems are available with pumps or pressure tanks for water supply.[8]

The first edition of NFPA 750 contains a water mist category classification, classifying the generated droplets by sizes. According to this classification, Class I systems generate the smallest droplets and Class III systems generate the largest ones.

Following is a description of the possibilities of application for primarily Class I systems because such systems are the ones differing most clearly from conventional deluge and sprinkler systems in their mode of action.

Applications in the industry

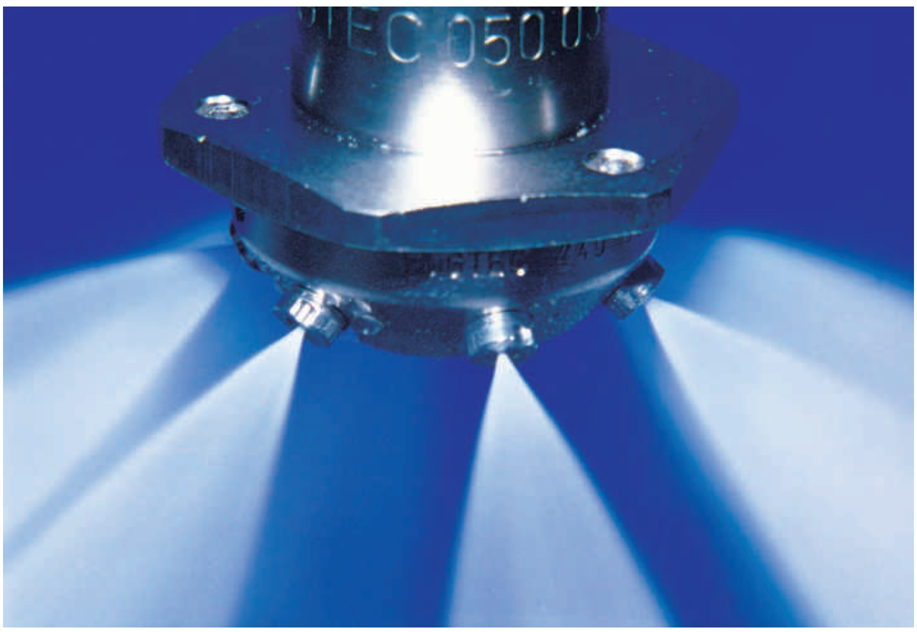
There are numerous possibilities for the application of water mist in industry and they are being steadily increased by new ones. In this context, it becomes evident that water mist systems are apt to replace both sprinkler and gas extinguishing systems under certain conditions. Following, are examples of some of the risks that are frequently protected by water mist.

Local Protection/Object Protection

Water mist systems for local protection already exist in almost every branch of industry. Risks covered by local protection systems rather often necessitate the activation of fire fighting installations. For this purpose, high-pressure water mist systems offer the great advantage that refilling can be done fast and at a low cost. Apart from that, the water damage caused can mostly be neglected, and potential damage to the product can be reduced to a minimum. These factors are of particular importance for systems exposed to a high false alarm rate.

Gas turbines

Gas turbines are one of the risks most frequently protected by water mist. At a very early stage, Factory Mutual published directives for the approval of water mist systems for this range of application. As a result of this initiative and because of the specific advantages of water mist technology, such systems became wide spread in a very short time. Water mist will reduce the temperature in the area around the turbine rapidly, however without cooling the



Fogtec nozzle for industrial applications.

turbine surface too fast and too irregularly whereby the turbine would be damaged.

Machining centres

Particularly the PLC controlled machining centres are suited for protection by water mist. Such centres often use an oil mist for cooling the tools and for lubrication. If this oil mist is ignited, it can be extinguished with Class 1 Water Mist within seconds despite the tremendous speed with which the fire is spreading, even in cases where a protection door of the machining centre is left open. Owing to the small amounts of water used, the machine normally can be restarted after a short time.

Engine test cells

A great number of engine test cells have already been protected by high-pressure

Fire test for industrial applications.

water mist systems, and they have in reality proved to be reliable systems on various occasions. The high financial and development values in the automobile industry plus the desire for immediate and effective fire fighting create a convincing argument in favour of the use of water mist as extinguishing medium.

Cable ducts

By using high-pressure water mist extinguishing systems, it is possible to avoid consuming those large amounts of water that would regularly be required when using low-pressure spray flood systems.[9] This is indispensable particularly to avoid short-circuits. The almost gas-like spreading of Class 1 mist permits the reduction of the amount of nozzles installed in most instances to a single row, which guarantees easy access to the cable duct.

Hydraulics cellar and production areas

High-pressure water mist systems have been tested for room heights up to 10 m in 1/1 fire tests. It has been possible to prove that an effective protection can be provided with extremely low quantities of water, while it is nevertheless important to see to it that the respective water mist system has really proved its effectiveness in tests with the corresponding room height.

IT areas/control rooms

Also the IT areas maintained by industry to an ever-increasing extent can be protected with water mist.[10] Several thousand square metres of protected area alone in Europe are a clear demonstration. Especially the fume washout effect by which smoke particles and the

water-soluble fumes are removed,[11] has a positive effect on the protection of these areas. In most cases, computers with their CPUs and particularly also their storage media are less affected by the fire itself than by the rapidly spreading fumes with their often aggressive components.[12] Water mist is also increasingly used to protect floor voids in computer rooms.[13]

Hazardous materials stores

Investigations by North-Rhine Westphalia's State Environment Board have shown that in most cases high-pressure water mist is superior to CO_2, which has otherwise been frequently used for such applications.[14] By avoiding pre-warning times, a rapid spreading of the fire, which would otherwise have to be expected, can be counteracted. Other important advantages are the redundancy of completely confined spaces and the powerful cooling effect.

Other applications are:

- Chip board presses[15]
- Belt conveyors[16]
- Paint Cabinets[17]
- Wet benches
- Transformers
- Generators
- Industrial oil fryers and ovens

Fire test for industrial applications.

Summary

Water mist extinguishing systems enjoy a rapidly increasing acceptance in industry. For many applications, water mist as compared to conventional fire fighting techniques and chemical extinguishing gases is not only environmentally friendly, but also the more effective alternative.

But like any other fire-fighting system, water mist extinguishing systems cannot protect every risk. Water mist systems require detailed design based on the corresponding 1/1 tests, and installation by experts. Only then can the enormous advantages of the technology be turned to profit. For the users of water mist technology, it's therefore important to ask a prospective supplier for references, design bases and experience. Equally important is a careful selection of the fire detection and alarm system.

1 FM Global Research, Water Mist Protection Systems gain Momentum, in: IFP, Nov. 2000.
2 Dr. Joseph Su, NRCC, article on web page nrc.ca/irc/newsletter/v6no1/halon_e.html
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4 Loss Prevention Council, in: "Report Halon Alternatives", 1996
5 T. Prößdorf, Löschmittel im Einsatz und deren Auswirkung auf Umwelt und Gesundheit, in: Wagner Seminar, 1994
6 e.g. NFPA 750, Factory Mutual (var.), UL, IMO (var.)
7 e.g. CEN, DIN, Standards Australia, JFOA, other directives by Factory Mutual
8 For other details regarding the different types of water mist systems, see IFP Magazine, issues 1 and 2, 2000, "Water Mist Extinguishing Systems" by Dirk K. Sprakel
9 H.G. Schroers, Wassernebel unter Hochdruckeinfluß, in: W&S, 10/2000
10 U. Schwemmer, Stationäre automatische Wasservernebelungsanlagen, in: TÜ, Vol. 38, May 1997
11 FM Global Research, Water Mist Fire Protection Systems gain Momentum, in: IFP, Nov. 2000
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13 FM Global Research, Water Mist Fire Protection Systems gain Momentum, in: IFP, Nov. 2000
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16 K. Holke, H.D. Dortmann, Brandschutz von Bandstraßen mit Gurtförderanlagen ..., in: VGB Fachtagungsband, 1999.
17 U. Schremmer, Anlagentechnischer Brandschutz in elektrostatischen Pulver-Lackieranlagen ..., in: TÜ, Vol. 39, May 1998

Valves Solve Seawater Problems

Figure 1. OCV Red Valve – shows two gauges.

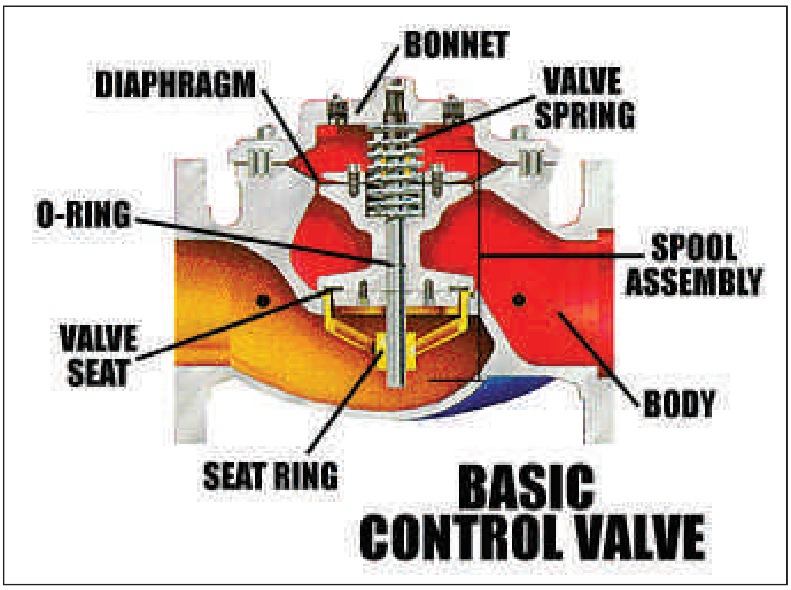
Valves operate either on or off (opened or closed), or somewhere in between. A simple fireplug is nothing more than a valve that controls flow of water to fight a fire.

Valves can also be equipped with all sorts of "bells and whistles" that cause the valve to operate at various stages between on and off as a result of pressure changes, temperature, time, or other factors. Correct application of any valve requires defining the specific purpose or function of the valve, sizing it to the operating conditions and selecting the materials of construction to the conditions and fluid. The use of valves in a salt-water environment or in piping with another corrosive product presents special challenges to the engineer and valve manufacturer.

Veco Alaska, an engineering contractor and consulting firm, faced this challenge recently when looking for valves to use in fire protection systems in Alaska. The fire-fighting agent was salt water. Veco was designing and installing fire protection systems at an oil recovery facility in Valdez, and at an oil production facility on NorthStar Island, a man-made island in the Beaufort Sea at the North Slope. Both systems would work "on demand" without human intervention.

The valves were to be installed on the discharge side of fire pumps taking water directly from the sea. Their purpose was to keep the fire system piping isolated from salt water until it was needed. This piping system would be filled with fresh water and charged to a pressure that would keep the valve closed. When the pressure on the discharge side drops, the valve opens, allowing 100 psi seawater from to the fire main to flow into the fire system. After the fire is extinguished, the fire system would be flushed with fresh water and charged, closing the valve and placing the system in standby.

Figure 2. Drawing cutaway of valve.



These valves, always subject to salt water and its corrosive effects, could leak unless protected. Industry standard materials range from cost effective, readily available ductile iron and cast steel to costly, special order alloys like nickel-aluminum-bronze or duplex stainless steel

With this problem in mind VECO worked with OCV Control Valves of Tulsa, and found a solution. Involved in the design, engineering, manufacturing and application of specialty valves for the past 50 years, they suggested the application of an epoxy coating that is resistant to saltwater corrosion, as well as to corrosion caused by refined petroleum products, sour crude and other acidic compounds. These coatings have elastomeric properties that allow expansion and contraction within a wide temperature range. Following rigid application steps, they have

Figure 3. Aerial view of NorthStar Island. *Pic: Jack Bowen © BP*

found these coatings to be durable for in excess of 15 years.

At Valdez, a new fire protection system was installed in a facility where oil is recovered from the ballast water used in tankers. Underground seawater fire mains feed the fire protection system. Three 6,000-gpm diesel driven pumps supply seawater from Prince William Sound at 275 psi to the entire Valdez terminal.

The control valve used here, and shown in Figure 1, is an OCV Series 127 pressure reducing flow control valve that controls water supply to the building sprinkler system. It controls flow and reduces the 275-psi supply pressure to 100 psi and sustains that pressure and flow in the fire system. Should the seawater fire main pressure

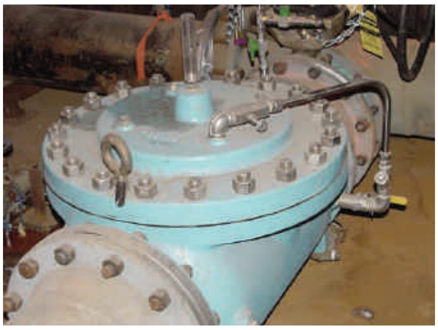


Figure 4. Blue Valve.

vary, the valve modulates until the pressure is correct. The valve seat is part of a spool assembly that opens and closes hydraulically. A diaphragm senses pressure changes and activates the valve seat, adjusting it as necessary so that preset pressure and flow are maintained. Figure 2 shows the internal workings of the basic control valve.

At the production facility on the man-made NorthStar Island in the Beaufort Sea, shown in Figure 3, a different type of control valve is used. Twelve-inch Diaphragm Check Valves are placed on the discharge side of the fire pumps that supply fire protection water taken from the Beaufort Sea to the island fire system. Shown in Figure 4, these valves have the same innerworkings of the Series 127 valve and are designed to open when inlet pressure exceeds discharge pressure on the fire system side. Should pressure reversal occur, internal control tubing carries back pressure to the bonnet, forcing the valve to close. The valve seat operates hydraulically. Like in the Series 127 installation, the fire system remains charged with fresh water. When the pump starts, and pressure in the valve exceeds fire main pressure, the valve opens. Another 12-inch valve, shown in Figure 5, is an angle valve that provides pressure relief for the fire pump. When the water supply exceeds the demand, this valve releases it back to the ocean. Elsewhere in this system are 3″ and 2-$\frac{1}{2}$″ inch Series 127 valves regulating fire system pressure at 150 psi. All have the epoxy coating.

Veco used these Control Valves because they were of high quality, meeting UL and FM standards for fire protection, and the delivery time was acceptable to their working schedule. The engineering staff worked with Veco engineers to make sure that the valves met all of the requirements of the application.

About the Author

Jack Bowen has worked with fire protection systems for the past 34 years, the last 11 of which have been in the oil business in Alaska. He has extensive experience in the design, testing and certification of high and low pressure CO_2, foam and chemical systems, and has worked in a number of industries, including high rise buildings, research facilities, nuclear power, data processing, and schools, as well as the petroleum industry. He attended Kearney State College in Nebraska and various fire protection seminars and training sessions. He holds Alaska State Fire Marshal permits IC, IIC and IIIC as well as NICET certifications. Please contact him at jack.bowen@veco.com

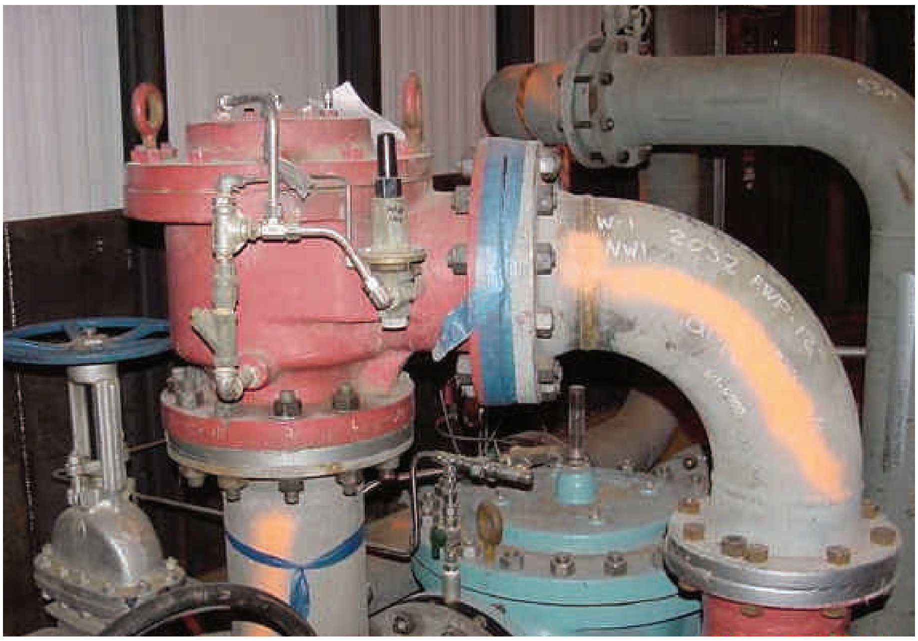


Figure 5. Another red valve. This is an angle valve.

Hospital Fire Protection

Central Dupage Hospital. *Courtesy of RJA*

FIRE PROTECTION engineering for healthcare facilities requires a different approach than would be used for most other building uses. While the majority of occupancies depend on evacuation for fire emergencies, healthcare facilities must "defend-in-place". In using this approach, a greater dependence must be placed on life safety systems for protecting the occupants from fire. In the defend-in-place approach fire alarm, suppression and fire resistive construction all work together to avoid moving patients out of the building. Ideally any vertical movement of patients is avoided since it can be stressful, even dangerous, to the patient. Trained staff, familiar with emergency procedures are depended on to assist patients in a fire and move them to a safe area.

By **Craig L. Redfern**, P.E.,
Rolf Jensen & Associates, Inc.

The definition of healthcare is important to determine how to apply the applicable codes. The National Fire Protection Association (NFPA) 101, 2000 edition, *The Life Safety Code* (LSC) is enforced most universally in the United States. Many jurisdictions also enforce a model building code, such as the *International Building Code* (IBC), which may contain additional, sometimes more restrictive, requirements. There are numerous definitions of healthcare, but the most basic involves sleeping accommodations for people incapable of self-preservation because of age, physical or mental impairment. This would include primarily general and psychiatric hospitals and nursing homes. Ambulatory healthcare is a related occupancy, but with less restrictive requirements. Other occupancies that may be associated with healthcare, but do necessarily require the same level of fire protection, would include doctor's offices, clinics and small treatment facilities. These latter building uses are typically treated as a business or other less restrictive use. As always, the Authority Having Jurisdiction (AHJ) must be consulted if there is any doubt about the occupancy.

Once it has been determined the overall occupancy is healthcare, typically there will be other occupancies in the same building. The LSC section 18.1.2.1 allows other occupancies to be applied in a building primarily used for healthcare along with the code advantages of that

Northwestern Medical. *Courtesy of RJA*

occupancy (for example the ability to reduce corridor width in a Business occupancy). However, the other occupancy must not be used by patients for sleeping, treatment or by those incapable of self-preservation. The occupancy must also be completely separated from healthcare by a 2-hour fire resistance barrier without penetrations other than self-closing fire doors in corridors. If this separation cannot be achieved, the most restrictive requirements for both occupancies must be applied. Further, if the non-healthcare occupancy is to be used for egress of healthcare occupants, the means of egress provisions for healthcare must apply throughout.

The LSC and model codes allow for some flexibility in applying the prescriptive measures in the code. Prescriptive referring to the specific instructions as outlined in the occupancy chapters of the code. LSC section 18.1.1.1.1 has an exception allowing the AHJ to approve an equivalency. Further, although the LSC does not require any specific method for achieving this equivalency, NFPA provides two methods to assist in evaluating alternate designs. The Fire Safety Evaluation System (FSES) and LSC Chapter 5 *Performance-Based Option*. As one would expect, each approach has its advantages and disadvantages.

The FSES for healthcare occupancies is detailed in Chapter 3 of NFPA 101A – *Alternative Approaches to Life Safety*. The FSES for healthcare first appeared in 1981 as an appendix to the LSC and now appears as a recommended practice. The FSES provides a method of "scoring" points for various life safety features of

Hospital Fire Protection

the facility. The resulting points are totalled and compared with the potential points for a facility in full compliance with the prescriptive portions of the LSC. If the facility can demonstrate that it has a point value greater than or equal to a traditionally compliant facility in four major categories, then equivalence has been demonstrated. The four major categories evaluated are Fire Containment, Fire Extinguishment, Emergency People Movement and General Safety. Since fire sprinklers are required for new healthcare occupancies, a large score of 10 points is included for fully sprinklered smoke compartments. This makes the FSES very difficult to compensate for a lack of sprinklers. Other major components of the FSES include protection of hazardous areas, corridors and vertical openings.

The approach provided in LSC Chapter 5, *Performance-Based Option* is a new section to the LSC and provides specific goals and objectives without prescribing how to achieve them. Although some designers fear this is "throwing away the code", Chapter 5 still requires some prescriptive code provisions be retained. The means of egress requirements for stairs, ramps, doors and lighting as well as other provisions must be incorporated in the design. However the chapter primarily focuses on selection and evaluation of specific fire scenarios. Based on criteria agreed upon by all parties, challenging but realistic fire scenarios are evaluated. The scenarios provided attempt to evaluate predicted response of the building systems and personnel to a given fire event. Perhaps the most exciting aspect of the Performance Based Option is the tools and the method can be used to evaluate fire and non-fire events. By changing the scenarios to address non-fire emergencies, a variety of design issues can be evaluated. With recent tragic events, evaluating the response of facilities to a variety of disasters has become essential.

A note of warning is appropriate when using alternate code approaches and equivalencies. Hospitals tend to have multiple, overlapping AHJ. The Center for Medicare and Medicaid Services (CMS), The Joint Commission on the Accreditation of Healthcare Organizations (JCAHO), State health agencies and local fire departments are some of the important parties to consider. An approval by one AHJ does not constitute an approval by all parties in that role. All authorities responsible must approve any alternate approaches before it can be considered an acceptable equivalency. Since LSC Chapter 5 *Performance-Based Option* is new, many jurisdictions are not prepared to evaluate this method and may need to have a third party review of the documentation. The use of alternatives must be addressed early in the design process and include all stakeholders.

Another situation commonly encountered in existing hospitals is areas that do not comply with the LSC for existing healthcare occupancies (LSC Chapter 19). Additions to non-complying areas must be completely separated by a 2-hour fire resistance rated barrier, without communicating openings other than fire rated corridor doors. When renovating an area, LSC Chapter 18 (new construction) applies to that area and unless the renovation is minor, applies to the entire smoke compartment. There is no set "trigger point" to determine when a renovation is large enough to require an upgrade to the entire smoke compartment. The AHJ will determine when a renovation is considered minor and involves the entire compartment. This determination should be made early in the design process if there is any doubt about required upgrades.

The requirements for 2-hour fire resistant barriers lead to some interesting design approaches by facilities. Many hospitals surround all new construction and renovation projects with 2-hour firewalls without evaluating the adjacent space. This approach leads to some very confusing and expensive wall arrangements. It is not unusual when a life safety evaluation is performed on an older facility, to find many firewalls that no longer appear to serve any purpose. These walls can be de-rated and significantly reduce maintenance and renovation costs.

Pic: courtesy of FSSA

As a defend-in-place structure, the goals and objectives are stated in LSC section 18.1.1.2. Primarily the intent is to limit the fire to the room of origin reducing the need for occupant evacuation. This goal is achieved with a total concept of design, construction and maintenance. The LSC further elaborates that the total concept is achieved with three major parts. The first part is also the last line of defense: Construction and compartmentation. The second part is detection, alarm and suppression. Third part of the total concept is fire planning and prevention. Section 18.7 details the operating features of the building including fire drills and maintenance of fire protection features. The primary focus of the LSC, however, is

the second and last lines of defense. In other words, the design team must assume the worst case – a fire has started.

The LSC requires all new healthcare facilities to be sprinklered and existing facilities based on height and construction type. Quick-response sprinklers are required in new sleeping smoke compartments to achieve the highest level of protection. The code does allow alternate protection methods to be substituted for sprinklers if the AHJ has prohibited sprinklers in a specific location. This is most common in electrical spaces. The code further requires protection with a fire alarm system for new or existing healthcare facilities. Sprinkler flow alarm switches, manual fire alarm boxes or smoke detectors would activate the fire alarm system. Smoke detectors are required in nursing home corridors or where hospital corridors have certain open spaces allowed. The LSC requires emergency forces notification on fire alarm, but allows a 120 second reconfirmation feature to be programmed into the fire alarm for smoke detection. As more reliable smoke detection technology develops, reconfirmation should become obsolete.

The last line of defense for the building is fire rated construction to limit the spread of fire and protect from structural failure. This is achieved by requiring minimum structural fire resistance based on the building height. The model codes further add limits to area based on structural fire resistance and sprinkler protection. Another level of protection is gained through compartmentation. Such that, each floor is divided into smoke compartments no larger than 22,500 square feet. The walls separating these compartments are one-hour fire and smoke rated construction. A minimum of two smoke compartments are required on any healthcare floor providing a safe place to relocate the occupants without the need to use stairs.

The patients are further separated from potential fire effects by corridor construction. In sprinklered new or existing hospitals, the corridors are not required to be fire rated, rather just resist the passage of smoke. These non-rated corridor walls may even terminate at a lay-in ceiling provided the ceiling would resist the passage of smoke. In the case of existing non-sprinklered hospitals, the corridor walls must be 30-minute fire rated and extend through any suspended ceilings. The doors to the corridor accessing the patient rooms are not required to be fire rated. In fact the LSC now specifically states compliance with NFPA 80, *Standard for Fire Doors and Fire Windows* is not required. Further the LSC allows up to a one-inch gap at the bottom of the door. This recent wording has been added to clear up a source to confusion for enforcing authorities and designers alike. In order to be a tested fire rated door, it would have to have a self-close feature. It has been considered that self-closing patient room doors may add to confusion when staff are trying to evacuate patients in a fire event and so are undesirable. Self-closing hardware is required any fire rated wall opening.

Texas Children's Hospital. *Courtesy of RJA*

The areas in hospitals that represent a significant hazard because of fire loading or likelihood of ignition must be separated from patient care areas. In new facilities sprinklers are required in all locations and where the hazard is severe a one-hour fire resistance must also be added. Section 18.3.2 defines hazardous areas or in some cases refers to other standards for guidance. Some examples of hazardous areas include Paint Shops, Laboratories, Soiled linen rooms and storage areas. For existing facilities, these hazardous areas can be sprinklered and smoke tight with self-closing doors OR one-hour fire rated. The LSC further allows the use of domestic water sprinkler systems as described in section 9.7.1.2 for protecting existing isolated hazardous areas. Basically, up to six sprinklers can be used to protect an isolated hazardous areas piped directly from the domestic water system. The system must be capable of providing a water density of 0.15 Gallons-per-minute per square foot of area. If more than two sprinklers are used, water flow detection must be included and sound an alarm or notify a constantly attended location. This provision allows existing facilities to protect areas without the major expense associated with a complete sprinkler upgrade. Domestic water sprinkler systems still require engineering and careful consideration of the hazard involved.

This has been just a glimpse of some of the issues confronting the design team for hospital fire protection. Hospitals require constant evaluation of life safety readiness and reaction. Fire drills are required quarterly for each shift to maintain readiness. The required staff training as well as the multi-leveled total concept approach has had a major impact on healthcare fire safety. According to NFPA Statistics on facilities that care for the sick, between 1994 and 1998, there was an average of 5 civilian fire deaths in an average of 2,600 structure fires per year. That accounts for 0.1% of the civilian structure fire deaths in that period. This is an admirable record and is clearly a result of the total concept approach to hospital fire protection.

References:

National Fire Protection Association (NFPA) standards:

80 – Standard for Fire Doors and Fire Windows

101 – Life Safety Code

101A – Guide to Alternative Approaches to Life Safety

The U.S. Fire Problem Overview Report Leading Causes and Other Patterns and Trends Facilities that Care for the Sick – Marty Ahrens (NFPA) June 2001

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Craig L. Redfern, P.E. is a consulting engineer with the Orlando office of Rolf Jensen & Associates, Inc. (RJA). Mr. Redfern has over 13 years of experience in the design, surveys, and code requirements of healthcare facilities. To learn more about RJA visit their website at www.rjagoup.com.

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Brunel would be impressed

ISAMBARD KINGDOM BRUNEL is well known for his civil engineering accomplishments, particularly much of the construction of Britain's railway network and it's infrastructure. It is perhaps less well known that he was also responsible for the construction of many of the hotels that are located adjoining some of the UK's major railway stations.

The original constructions were of course some time ago and recently two of the hotels, the Great Eastern next to London's Liverpool Street station and the Great western adjacent to Paddington station, have been completely renovated. In both cases, much of the buildings international structure was removed, leaving just the external fascia unchanged. The Great Eastern Hotel renovation was completed four years ago but the great Western Hotel's 16-month refurbishment project is just nearing completion.

Both restorations have benefited form the installation of a specialist fire rated ductwork system manufactured by Bishops Stortford based FIRE PROTECTION LTD (FPL) – a modus operandi Mr. Brunel would almost certainly have incorporated had the facility been available in his day.

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Full details concerning the fire rated ductwork system are contained in FPL's updated 24 page Flamebar BW11 technical manual, which also includes new sections on panel ducting protection, as well as solutions for achieving lower installation temperatures and graphs showing air temperatures at various distances from a duct. The publication advises "when and why" fire resistant ductwork should be used and also contains a comprehensive section on analysis and performance. Helpfully, it itemises British and ISO testing requirements and regulations, as well as codes of practise applicable in the UK.

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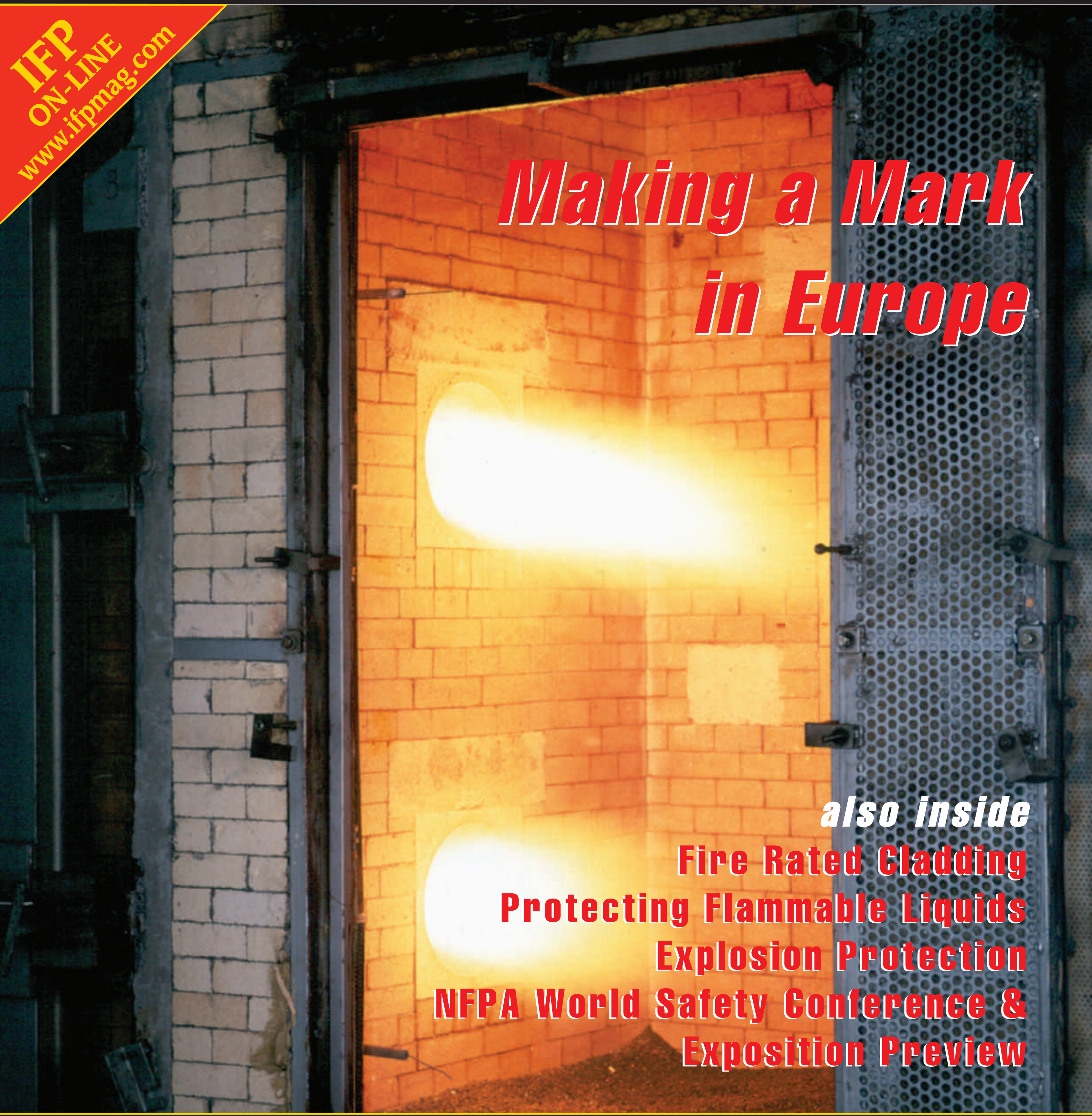

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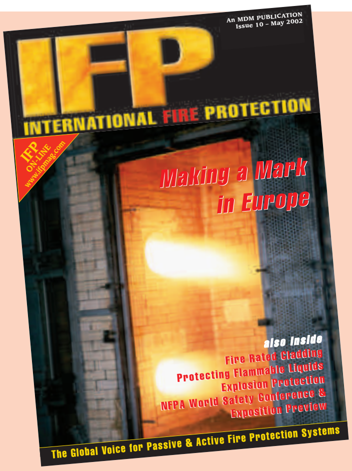

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Glass under furnace test –
Picture Courtesy of Pilkington Brandschutz

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Pic: courtesy of Pilkington Brandschutz

Making a Mark in Europe

The new product, classification, and test standards under the European banner are not so far off. Much has yet to be done, but the wider communication process is well under way. It is therefore entirely appropriate that fire professionals consider the practical implications as implementation becomes a reality. When it comes to fire-resistant glazing, applications are not as straightforward as one might imagine in comparison with other fire-resistant materials.

***MIKE WOOD* of the global glass company Pilkington flags up some of the considerations that have to be held in mind concerning fire-resistant glazing when it comes to raising the European standards.**

It came as something of a surprise to me late last year at the Luxembourg conference of the European Association of Passive Fire Protection to hear Mr Leoz-Arguelles of The Commission say that the objective of the European process of harmonisation of standards was *not* to deliver safer buildings. The stated objective of the process set in train by the Construction Products Directive is to remove technical barriers to trade. The goal is simply a single market without frontiers. The mark of compliance with the Directive and the new standards is the CE Mark, which in effect becomes a product passport enabling free placement on the Community-wide single market. No passport, no travel.

In practice this cannot be, and must not be, the whole story. Annex I in the Directive describes the essential requirement concerning fire as “Safety in case of fire”. If a product complies with the relevant European harmonised standard then according to the Directive there is also a presumption of fitness for intended use. The natural expectation, and common interpretation, is therefore that the harmonisation process will lead to, if not safer buildings, at least installations – or parts of works in the language of the Directive – with a demonstrated level of (improved ?) fire safety. This should be implicit in the process. And that basically was the expectation that a succession of representatives from industry expressed at the EAPFP conference, one after the other. The general concern, however, seemed to be that the process, as it is turning out in practice, may well fall short of best expectation. A lot of us have spent considerable time and resources in placing products on the market very much with fitness for intended use, firefighter protection, people safety and asset protection in mind. If CE Marking is not going to advance the cause of enhanced fire safety across Europe then surely we need something that does. In particular, the question of certified installation, specifically excluded from CE Marking, comes immediately to mind. This is where early initiatives like FIRAS in the UK, pioneered by the Glass and Glazing Federation, may point the way to the future.

Nevertheless, the focus on harmonised standards driven by the harmonisation initiative, and the momentum building behind the CE Marking process, do serve to put fire safety clearly under the spotlight.

Where fire-resistant glass is concerned the harmonisation process is not quite complete. A new standard procedure for the furnace testing of fire resistance is available – essentially the much discussed plate thermocouple – and the final product performance classification document is expected within the year. But, the final part of the glass product standards will not be through the CEN process for maybe one to two years.

In particular, there is not yet any where near sufficient test experience in the public arena with the new fire resistance test. The limited experience available is not yet enough to demonstrate that the original objective of better consistency from test to test and from furnace to furnace will actually be

Pic: courtesy of Pilkington Brandschutz

achieved. Time will tell. The broad conclusion from the recently reported results of the RADAR 1 programme indicate that the EN test is relatively more arduous than the UK standard test in gas fired furnaces, by something like 2% to 20% – a somewhat wide range which reflects that the outcome can be rather product specific, even within the same product family. The comparative level of performance from the old tests to the new EN test may well be different in the oil furnaces used across Europe.

Although the final steps to allow CE marking of fire-resistant glazing have still to be taken, the whole involved process of discussion and drafting has served a useful purpose in heightening issues related to product performance and product evaluation. In particular, the requirement for System 1 attestation of conformity for materials whose intended use is safety in case of fire is certainly a welcome step in the right direction. Fire resistance calls for product certification by an independent Notifed Certification Body, as accredited by a member state. Part of this attestation process is initial type testing of representative samples selected by a Notified Body, together with surveillance of the associated factory production control system. Such a requirement is not currently required by most of the approvals processes in place across Europe. This will take us somewhat down the road towards evaluation of fire performance consistency and reliability, which is a prime concern of manufacturers in delivering fitness for purpose.

When it comes to considerations of fire safety then glass is without doubt one of the most important building materials. Glass is more widely used in today's buildings than ever before. The benefits are obvious. Lighter and more open buildings create a more pleasant and amenable living environment. Glass can provide such a unique range of performance features, including security, impact safety, thermal insulation, sun screening, and decoration. That glass can also be fire resistant can come as a surprise. Standard annealed window glass cracks under relatively mild heat stress or thermal shock. Even toughened glass, a traditional and effective glass for impact safety, can shatter somewhat unpredictably if the thermal stress exceeds the critical fracture value, quite possible under fire conditions. If such a toughened glass should fracture, then the result is dramatic: explosive failure as the stress originally built up in the glass during the toughening process is suddenly released in one go. All that's left is a hole where the glass used to be and a pile of pieces. In such a potential situation, fire safety becomes a question of probability rather than certainty.

Furnace test – Pilkington Brandschutz.

What should be understood then in advance of the introduction of CE Marking? A special technology is needed to produce a reliable fire-resistant glazing. There also has to be on the part of the manufacturer a clear focus on fitness for purpose to achieve consistency and reliability of performance in a fire. There can be no room for failure. Lives are at risk. The golden rule is that fire-resistant glass must only be used as part of an approved assembly, which means the glass, the frame, the glazing materials and fixings all taken together as an integrated system. It is the whole system taken together which has to function as a fire-resistant barrier. The system must also be assembled and installed exactly as approved. The frame and materials must be appropriate for the glass used in the system. Mixing and matching between different systems is also dangerous, as are unauthorised changes, since fire behaviour of different combinations is not necessarily readily predictable or calculable.

It's also important to keep in mind that there is no such thing as a generic fire-resistant glass. What is achievable with one may not be achievable with another. The technical performance characteristics could well be different, as can the framing specifications and the available framing options. Approvals only apply to the particular configurations tested, certain specified glazing sizes or aspect ratios, framing materials and designs. For one particular type of glazing, as illustrated by the RADAR results, the chance of achieving a successful test result without catastrophic failure – as it happens at both the current British Standard and the new EN test methods – is critically dependent on following exactly manufacturer's specific guidelines concerning, in particular, installation, glazing materials and edge cover. On the other hand, wide testing experience has shown that other fire-resistant glazings are not that sensitive to framing conditions. So, it is important to go separately into the test pedigree of each fire-resistant glazed system. There can be big differences. In each case the CE Mark information will need to be scrutinised to identify the exact scope and conditions that apply.

At the moment there are as many standards available across the Community relating to fire resistance as there are members. The intention is to replace these by a common set of reference standards and a common process for evaluating conformity to the standards. It would be a mistake to think that CE Marking brings a step change. It won't. CE Marking will not provide all the required controls. Much remains in the hands of the manufacturer. Responsibility for regulation, and enforcement, also remains within the scope of national authorities.

The whole CE Marking process, however, provides a certain structure that re-emphasizes the fundamental unchanging principles that apply to fire safety glazing installations. The fundamental result is to pave the way in the Community for at least a common basis of understanding, founded on a common approach, with anticipated benefits in terms of enhanced fire safety. Let's look forward to its arrival.

Pic: courtesy Dätwyler (UK) Limited

Life and Property Protection in Tunnels

Innovative approaches to safeguard human life and continuity of systems

by Graham Small

Dätwyler (UK) Limited
Safety and Automation Group

Almost 20 years ago the first halogen-free safety cables with functional integrity were developed; these have since established themselves in the market under various trade names denoting low smoke emission, minimal toxicity, flame retardance and, in certain applications, resistance to fire. These are known by the general term LSOH-FR cables.

The first major projects were for nuclear power plants where multiple electrical systems had to be protected against the consequences of fire. Using LSOH-FR safety cables, in combination with fire-hardened installation and fixing systems, electrical functionality can be maintained for a determined length of time in the event of fire (between 30 and 90 minutes, depending on the system requirements). On the basis of this experience an extensive range of safety cable systems have been developed for use in buildings occupied by large numbers of people (such as high-rise buildings, office buildings, hospitals, airports, etc.), wherever the functioning of vital systems had to be maintained in the event of fire.

Using the technological advantages inherent in ruggedised life and property protection systems for commercial and residential property, these techniques have been adapted for use in underground railways and other mass transport facilities. This, in co-operation with relevant government authorities, contingency planners and engineering consultants, has lead to the development of safety systems aimed primarily at tunnel applications.

Astra Report

After the devastating fires in the Mont Blanc and Tauern tunnels, safety standards in Swiss tunnels were the subject of a detailed study conducted on behalf of the Department of the Environment, Transport, Energy and Communications (UVEK). As a first step, the safety of Swiss motorway tunnels was investigated by the Federal Office for Roads (ASTRA) in 1999. In mid-September of that year the Federal Transport Office (BAV) launched a further study related to safety in rail tunnels.

Analysis of road tunnels[1]

It is apparent from the report by the ASTRA Tunnel Task Force that safety in road tunnels depends largely on the following four factors: "road users, infrastructure, operation, vehicles". In the "infrastructure" sector, which is of relevance to our products and services, the following principle stood out:

> "The guidelines and requirements for equipping the tunnels must be updated to the latest state of the art. They include criteria for the employment and installation of tunnel equipment as well as a timetable for their implementation, and also stipulate so-called integrated functional tests. The guidelines include all components of the facilities, such as power supplies, lighting, ventilation, signal control, measuring and monitoring systems, central communications and information, cable connections, ancillary equipment and electromechanical related structural systems. An inspection is triggered by any new findings of a technical nature or of relevance for safety."

Among experts it is also largely agreed that – in the "infrastructure"

Pic: courtesy Dätwyler (UK) Limited

segment – tunnel ventilation plays a central role in preventing or limiting the spread of smoke or gas in the event of fire. The ventilation system is one of the few life-saving measures (presupposing the operation of the fire detection equipment) that can take effect immediately after a fire occurs. Equipped with individually adjustable flaps along the ceiling of the tunnel, a system of this kind can bring its entire capacity to bear exactly over the seat of the fire and thus efficiently extract smoke and toxic gases from the danger zone. This is what then makes immediate evacuation and fire-fighting possible!

Analysis of rail tunnels[2]

- 84% of the 689 tunnels reviewed are rated as problem-free with regards to safety.
- Additional measures need to be examined in the case of 84 tunnels between 300 and 3000 metres long.
- In 26 tunnels, most of them over 3000 metres long, the BAV also considers additional measures to be warranted with regards to facilities for rescuing oneself and others. These include:
- footpaths and handrails
- (emergency) lighting
- ventilation
- marked escape routes

Pic: courtesy Dätwyler (UK) Limited

So what contribution can cable manufacturers make towards the implementation and ongoing improvement of safety in tunnels? The above extracts from experts' reports make it clear that electric cable installations for power supplies and data transmission are extremely important! However, it begs the question:

> *"What use are ingenious facilities to protect life and property – such as ventilation systems and duct controls, monitoring, alarm, evacuation and fire-fighting systems in general – if power and data transmission networks break down in the early stages of a fire causing these very systems to fail when needed?"*

National and international guidelines already exist on the subject of "the behaviour of electric cables in the event of fire", of course. However, these guidelines only define minimum standards for cables and do not enable conclusions to be drawn regarding other crucial aspects such as correct installation methodology, proven materials, competence of the installer in mounting cable infrastructures and maintenance of the system, etc.

Certain manufacturers have moved away from the purely prescriptive approach of cable safety to set new standards here. It was clear to us some years ago that only co-ordinated and tested cable systems can be fully effective in an emergency. In close co-operation with partners in the field of preventive fire safety, cable systems were developed which guarantee uninterrupted power and data transmission for a defined period of time in the event of fire, providing a secure backbone for integrated safety. The functioning of fire-hardened systems are underwritten by extensive testing in large-scale furnaces. In support, technical conferences and certification courses are available that also offer the necessary support for the planning and professional installation of these systems.

To summarise: The maintenance of complex life and property protection systems within tunnel networks requires more than just safety cables that comply with national or international specifications. What is required is a cost/benefit-optimised, totally co-ordinated and tested cable system that guarantees the functioning of vital safety systems in fires! An holistic approach to continued functionality of systems in fires is the vanguard of this new approach.

[1]ASTRA Tunnel Task Force – final report dated May 23, 2000
[2]Report on safety in Swiss rail tunnels – BAV analysis dated January 22, 2001

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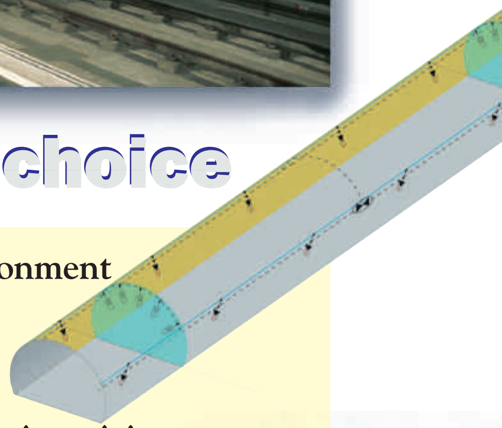

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Clean Agents and Clean Agent Systems

Mark L. Robin and Jason Ouellette, Hughes Associates, Inc.

Clean agent systems are ideally suited for the protection of sensitive electronics

Halon 1301: Here Today... Gone Tomorrow

Halon 1301 is an effective extinguishant at low concentrations, is low in toxicity, is electrically nonconductive, and exhibits long-term storage stability. Its claim to fame, however, is the property of cleanliness – the ability to extinguish fire without the production of residues that could damage the assets being protected. Because Halon 1301 is a clean agent, it has been widely employed in areas such as libraries and museums, where the use of water or solid extinguishing agents could cause secondary damage exceeding that caused by the fire itself. The nonconductive nature of Halon 1301 allows its use in the protection of electrical and electronic equipment, and its low toxicity allows its use in areas where the egress of personnel may be undesirable or impossible.

Due to its unique combination of chemical and physical properties, Halon 1301 has served as a nearly ideal fire suppression agent for over 30 years. However, due to its implication in the destruction of stratospheric ozone, the Montreal Protocol of 1987 identified Halon 1301 as one of numerous compounds requiring limitations of use and production, and an amendment to the original Protocol resulted in the halting of Halon 1301 production on January 1, 1994.

The current and future use of Halon 1301 within the European Community is governed by EC Regulation 2037/2000, which defines critical uses of Halon 1301. Critical uses for which Halon 1301 will be permitted include aircraft applications (e.g., crew compartments, engine nacelles, cargo and dry bays), military applications (e.g., engine compartments and occupied spaces in vehicles and vessels), and specialized inerting applications (e.g., Channel Tunnel, facilities processing radioactive materials, communication and command centers essential for national security).

In addition to defining critical uses, EC Regulation 2037/2000 sets the dates for the decommissioning of non-critical Halon 1301 systems. The sale and servicing of halon systems with virgin halon within the EC has been banned since 1 October 2000. Recovered, recycled or reclaimed Halon 1301 can be sold or used for existing systems for critical uses until 31 December 2002; after 31 December 2002 Halon 1301 can only be sold and used for servicing (refilling) halon systems that are listed as critical. Finally, all Halon 1301 units not listed as critical must be decommissioned by 31 December 2003.

In the United States, there are currently no regulations mandating the decommissioning of Halon 1301 systems. The U.S. Environmental Protection Agency (US EPA) strongly encourages the use of non-ozone depleting alternatives, and in 1990, the US EPA established its Significant New Alternatives Policy (SNAP) to evaluate new chemicals and technologies for the replacement of ozone depleting substances. On March 5, 1998, the US EPA issued a final rule governing the release of halons to the atmosphere during maintenance, repair, and disposal of halon containing equipment (http://www.epa.gov/ EPA-AIR/1998/March/Day-05/a5720.htm). Disposal of halon containing equipment must be conducted by a halon manufacturer, a halon system manufacturer, a fire equipment distributor, or a halon recycler. And, the company receiving the halon must operate in accordance with all requirements of NFPA 12A. If the owner is disposing of the halon permanently, it must be disposed of by sending it for recycling to a recycler operating in accordance with NFPA 12A. In order to recycle halons, Underwriters Laboratories

Table 1. Commercialized Clean Agents for Total Flooding Applications: Halocarbon Agents

	HFC-227ea	HFC-23	HFC-125	Iodotrifluoro-methane
Trade name	FM-200: Great Lakes Chemical Corporation FE-227: DuPont	FE-13: Du Pont	FE-25: Du Pont	Triodide: Ajay North America
Formula	CF_3CHFCF_3	CF_3H	CF_3CF_2H	CF_3I
Molecular Weight	170.03	70.0	120.02	195.9
Boiling point (°C)	-16.4	-82.0	-48.5	-22.5
Freezing point (°C)	-131.1	-155.2	-103	-110
Critical Temperature (°C)	101.7	25.9	66.25	122
Critical Pressure (bar abs)	29.12	48.36	35.95	40.40
Critical Volume (cm^3/mol)	274	133	210	225
Critical Density (kg/m^3)	621	525	571.9	871
Vapor Pressure @ 20°C	3.91	41.80	12.09	4.65
Liquid density @ 20 °C	1407	806.6	1218	2096
Saturated vapor density @ 20 °C	31.176	263.0	76.92	8.051
Specific Volume superheated vapor at 1 bar, 20 °C	0.1373	0.3409	0.1974	0.124
Cardiotox NOAEL (% v/v)	9.0	50	7.5	0.2
Cardiotox LOAEL (% v/v)	>10.5	>50	10.0	0.4
ODP	0	0	0	0.04
GWP (100 year)	2900	11,700	2800	<5
Lifetime, years	36.5	264	33	1 day
Class A Design Conc., % v/v	7.5	19.5	NA	NA
Heptane Design Conc., % v/v	8.6	15.6	10.5	3.9
Contact information	www.fm-200.com; www.dupont.com/fire	www.dupont.com/fire	www.dupont.com/fire	www.CF3I.com

Inc. approved equipment must be employed.

Halon 1301 systems in both the United States and the European Community can currently be recharged with recycled halon, or with halon produced prior to the manufacturing ban; after 31 December 2002 non-critical systems in the EC cannot be recharged. In Europe, the Halon Users National Consortium (www.hunc.org) can provide information on the procurement of recycled Halon 1301, and in the United States the Halon Recycling Corporation (www.halon.org) and the Halon Alternatives Research Corporation (www.harc.org) can provide information on the purchase of recycled halon and its proper disposal. Guidelines to the disposal of Halon 1301 can also be found at the HARC site and at the BFPSA site (www.bfpsa.org.uk).

ENTER CLEAN AGENTS

In response to the ban on Halon 1301 manufacture, the fire suppression industry has responded with the development of environmentally friendly alternative clean agents, that pose no threat to the ozone layer. Two classes of agents have emerged as suitable replacements: halocarbon-based agents and inert gas agents. The halocarbon-based agents are carbon-based compounds and extinguish fire primarily via the absorption of heat. Inert gas agents are based on the inert gases (i.e., nitrogen, argon, carbon dioxide) and extinguish fire via oxygen depletion.

Typical FM-200 clean agent system installation

Like Halon 1301, the new agents are clean, i.e., they leave no residues following extinguishment. As a result, no cleanup is required after discharge of the agents. Because the agents form no corrosive or abrasive residues they are suitable for use on delicate, expensive assets that might otherwise be totally destroyed by non-clean agents such as foam or water (for example books, paintings, and other cultural heritage items). The clean agents are non-corrosive and non-conductive, and hence can be employed for the protection of sensitive electrical and electronic equipment. Most of the new agents are nontoxic at their typical design levels, and hence are acceptable for use in occupied areas. The clean agents are gases, and can thoroughly flood a protected area, affording rapid extinguishment of even obscured or hard to reach fires. The clean agent systems are applicable to Class A, B and C fires, and when coupled with an early detection system clean agent systems provide rapid extinguishment, reducing equipment damage and ensuring the safety of personnel within the fire area.

Tables 1 and 2 compare the properties of the commercially available clean agents.

The clean agent marketplace is currently dominated by two agents: FM-200® and Inergen®. Clean agents are employed in a myriad of applications, including pleasure boats, marine and military vessels, flight simulators, medical facilities, cellular sites, internet service provider (ISP) centers, TV and radio control rooms, microwave relay towers, anechoic rest chambers, clean rooms, flammable liquid storage areas, art galleries, libraries and museums. Worldwide, numerous high value items are protected by clean agent systems. FM-200® suppression systems protect the electrical systems of the Eiffel Tower, the first draft of the Declaration of Independence, and protected the Star Spangled Banner during its recent restoration. Inergen® systems protect copies of the Gettysburg Address, copies of the Gutenberg Bible, and paintings by Picasso and Monet.

FE-125™ suppression systems protect the engine nacelles of the U.S. Navy F/A-18E/C and V-22 aircraft, and FE-13™ systems are employed in inerting applications on the North Slope.

CLEAN AGENT SYSTEMS

ISO 14520 specifies requirements and gives recommendations for the design, installation, testing, maintenance and safety of clean agent systems. The

Table 2. Commercialized Clean Agents for Total Flooding Applications: Inert Gas Agents

	IG-01	IG-100	IG-55	IG-541
Trade name	Argotec: Minimax GmbH	N100: Koatsu	Argonite: Ginge-Kerr	Inergen: Ansul
Formula	Ar	N_2	50% N_2 50% Ar	52% N_2 40% Ar 8% CO_2
Molecular Weight	39.9	28.02	33.95	34.0
Boiling point (°C)	-185.9	-195.8	-196	-196
Freezing point (°C)	-189.4	-210	-189	-78.5
Specific Volume superheated vapor at 1 bar, 20°C	0.602	0.858	0.708	0.697
ODP	0	0	0	0
GWP	0	0	0	0
Class A design conc., % v/v	38.0	NA	37.8	36.5
Heptane design conc., % v/v	48.8	43.7	42.0	43.9
Contact information	www.minimax.com	www.koatsu.co.jp	www.ginge-kerr.com	www.ansul.com

standard is comprised of part one covering general requirements and parts 2 through 15 covering agent-specific requirements. NFPA 2001 also specifies the minimum requirements for clean agent systems.

Critical to the design of any clean agent system is the associated detection system. Rapid detection is employed to ensure the fire is extinguished while still in its incipient stage, thereby limiting the damage to valuable assets. For example, in telecommuni-cations applications, detection is often desired at a fire size of 1 kW, or for extremely sensitive equipment, at a fire size of 0.1 kW. ISO 7240 and NFPA 72 are the standards for fire detection and alarm systems. Both standards deal with the application, installation, performance and maintenance of detection and alarm systems.

Clean agent system designs take into consideration the appropriate detection/alarm standard, the appropriate clean agent standard, and any other standards relevant to the specific application. For example, the design of a clean agent suppression system for the protection of a specific facility would involve adherence to three standards: NFPA 72 (or ISO 7240) for guidance on the design of the detection system, NFPA 2001 (or ISO 14520) for guidance on the design of the clean agent system itself, and the standard applicable to the particular facility. In addition, any local codes or standards, and any requirements mandated by the local authority having jurisdiction (AHJ) must also be adhered to in the design of a clean agent fire suppression system.

The requirements of ISO 14520 and NFPA 2001 with regard to system design

are similar in most aspects. However, ISO 14520 and NFPA 2001 currently differ in their requirements for the establishment of the minimum design concentration for systems protecting Class A (cellulosic) hazards. NFPA 2001 requires both wood crib fire and plastic sheet fire testing, and employs a 20% safety factor added to the experimental results. ISO 14520 currently includes only a wood crib fire test and requires a 30% safety factor added to the experimental results. Plastic sheet and cable tray fire tests are currently being considered by the ISO 14520 committee for inclusion in the next edition of the standard. Both the NFPA 2001 and ISO 14520 standards employ a pan fire test for flammable liquids, and require a 30% safety factor to be added to the experimental extinguishing concentration.

Appearance-wise, clean agent systems are similar in many aspects to Halon 1301 systems, although, in general, none of the clean agents can serve as a complete drop-in replacement for Halon 1301: all require modification to the piping systems and or nozzles and system cylinders. Halocarbon agents are stored as compressed liquefied gases, and systems are typically superpressurized to 25 or 40 bar with nitrogen, with the exception of FE-13, which does not require superpressurization. Inert gas agents are supplied in high-pressure gas cylinders, typically pressurized to 200 or 300 bar. For both halocarbon and inert gas systems, additional system components include the usual collection of selector valves, piping, and nozzles.

DOWN THE ROAD…

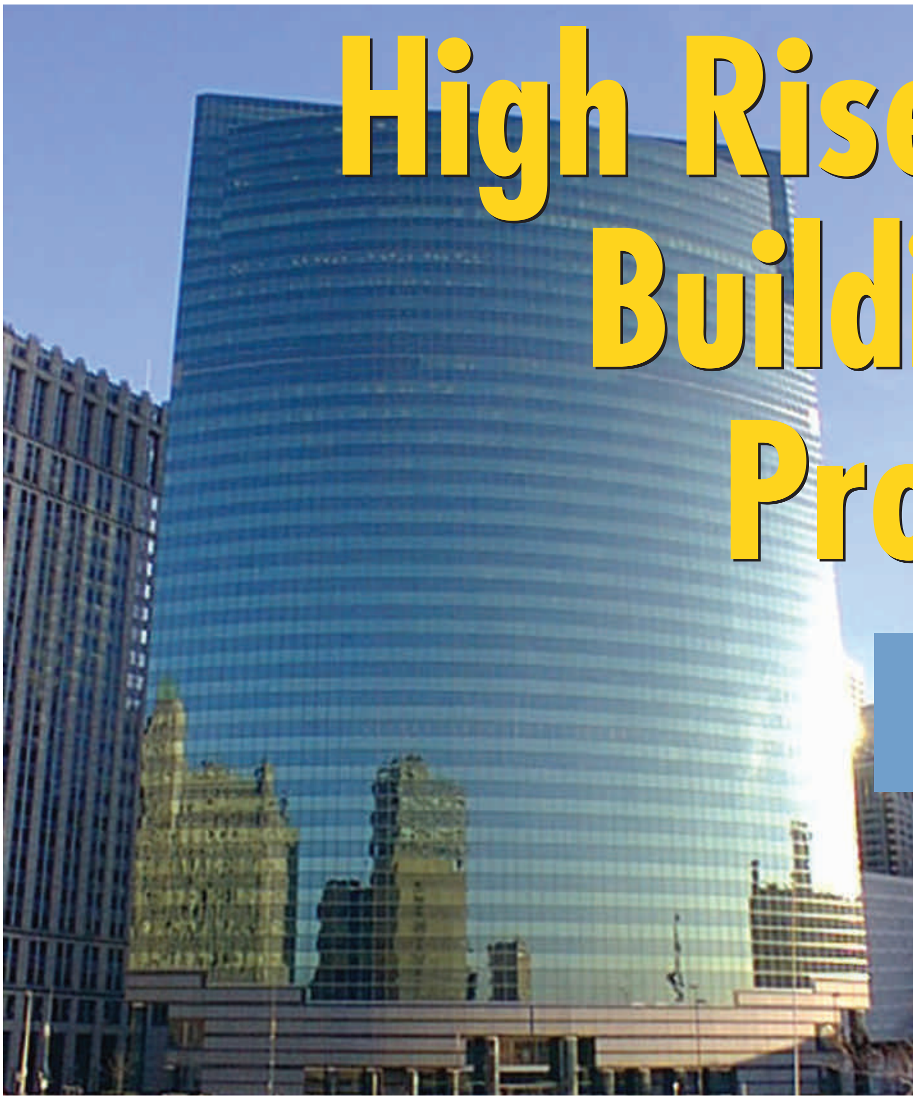
With the advent of the new clean agents, businesses worldwide will continue to have the ability to protect critical equipment and irreplaceable items, despite the ban and inevitable disappearance of Halon 1301 from the marketplace. With the mandated decommissioning of Halon 1301 in the EC and the increasing pressure from governments worldwide to reduce dependency on ozone depleting substances, it is expected that the future will see an increased utilization of the environmentally friendly clean agents. The commercial introduction of additional clean agents may also occur in the near future. Agents currently under development include Novec™ 1230 from 3M and NAF-S-125® from Safety Hi-Tech.

Mark L. Robin, Ph.D.

Mark L. Robin, Ph.D. is a Senior Scientist at Hughes Associates, Inc. He has over 10 years of experience in the field of fire suppression, including the development and testing of novel fire suppression agents and suppression techniques. He is actively involved in national and international standards development and approvals testing for fire suppression agents (NFPA 2001, ISO 14520), fire test method development, intellectual property and patent litigation services, and the management of R&D programs in the area of fire suppression.

High Rise Office Building Fire Protection

by Fang Li,
Rolf Jensen & Associates



Pic: courtesy of RJA

HIGH RISE BUILDINGS have been one of the most prominent symbols of economic growth for nearly a century. Yet, in the aftermath of the tragedies of September 11, "signature" high rise buildings have become the focus of much debate. Do we still want to build such large buildings? Can we adequately protect these buildings and their occupants? Based on the vast number of proposed high rise projects around the world, especially in Asia, it is clear that the desire to build such monuments is still there. In order for us to protect these buildings and their occupants, fire protection engineers will be facing an increasing challenge to demonstrate that the designs can meet the demands of their inherent fire and life safety risks.

With the fire and life safety concerns these structures represent, most modern building codes around the world have specific prescriptive requirements to address various aspects of their design. These prescriptive requirements address passive fire protection systems (fire resistance ratings of the structural elements), active fire protection systems (fire sprinkler and smoke control systems), communication systems (fire detection and alarm), and egress systems (stairs and refuge areas). The table (page 18) presents a comparison of representative prescriptive code requirements for high rise office buildings in different countries.

Although these codes are similar in many requirements, significant differences can be found. One such difference is in compartment size, where the Chinese code is very restrictive while the US codes have no limitation. Reasons for such differences include a country's economic condition, relative emphasis on active versus passive fire protection, climate, maintenance, and historical usage. China's reliance on fire and smoke compartmentation, coupled with natural smoke control, can be attributed to the considerations of cost effectiveness and reliability. But, such prescriptive approaches can often create problems for high rise buildings with mixed used occupancies, large assembly areas, or unique atrium designs. Relying on compartmentation can result in dividing the building into small cubes that limit architectural expression and effective functioning of the building.

The codes today are undergoing a major evolution to address the ability of providing flexibility in the design and use of the building together with cost-effective fire and life safety. Rather than only allow for the application of the restrictive prescriptive code requirements, codes are beginning to accept performance-based design approaches as an equivalency. The use of performance-based design can achieve a level of fire safety equal or better than the prescriptive code while providing the local authority having jurisdiction with an engineered basis for acceptance of the approach. Performance-based design provides the opportunity to overcome the differences between codes of various countries, allows designers to create engineered solutions, and results in cost effective global fire safety.

	Hong Kong	China	UK	US IBC	NFPA 101
Definition of high rise	30m or more in height	Over 24m in height	–	23m or more in height	Over 23m in height
Fire resistance	Decided by building construction function	Decided by building construction assembly	Decided by building construction function	Decided by building construction assembly	Not addressed
Maximum fire compartment size	$28,000m^3$ (above ground level) $7,000m^3$ (below ground level)	$1,000m^2$	No limit	No limit	No limit
Minimum Number of exits	2	2	2	2	2
Maximum Travel distance	36m	40m	45m	91m	91m
Area of refuge floors	Maximum every 20 floors	Maximum every 15 floors	No requirement	No requirement	No requirement
Number and location of fire elevators	Maximum 60m from most remote area to fire elevator	Decided by floor area, no location requirement	Decided by floor area	No requirement	No requirement
Emergency operation of HVAC system	Shut down	Shut down	Shut down	Shut down	Not addressed

The Petronas Towers, located in Kuala Lampur, Malaysia, offer a good example of the benefits of performance-based fire safety design. With heights of approximately 1,480 feet, the towers are the two tallest buildings in the world and are the home for the Malaysian government's gas and oil company as well as other multinational corporations that lease space. Rolf Jensen & Associates provided the code consulting and the fire alarm and emergency communications system design for this mixed-use project. A unique egress solution using the elevators and skybridges was developed, where the 750-ton skybridge connecting the towers in the middle serves as an emergency egress route between the towers and the upper and lower floors. The lobbies at each end of the pedestrian bridge were designed as fire compartments, each having its own separate HVAC systems. In order to limit fire and smoke spread, the connecting bridge area was compartmented by use of fire resistance rated assemblies with fire stopping systems. (Several tragic fires have occurred in other parts of the world where a similar approach was followed, but did not include a suitable fire stopping system.)

A fire alarm and emergency communications system designed in accordance with the NFPA 72 – "National Fire Alarm" standard together with redundant command centers was provided. The fire suppression system was designed to comply with the NFPA 13 – "Automatic Sprinkler Systems" standard. The combined use of local and international codes on a performance-based approach provided the designer with a more flexible design without sacrificing the level of fire safety.

Each country's codes have their own approach, logic, and advantages. For example, the Chinese code for high rise office buildings over 100 meters in height. It requires an area of refuge every 15 floors with the area providing a minimum size of $0.2m^2$/person. In the Chinese code there is no specific guideline to calculate the occupancy loads, so designers usually use other international codes and standards as the reference. For a 20 story building having 24,000 ft^2 per floor with an occupancy load of 100 ftgross area/person, we would have 240 people per floor. Using the code complying stairwell system, timed egress calculations predict that it will take about 51 minutes to evacuate the building. If instead of total evacuation, one moves people to a refuge floor, this time can be significantly reduced (in this case to less than 25 minutes). In China, the total height of 15 floors would be around 50 meters which is just within the range of the fire truck rescue capability in China, giving the options for the fire department to rescue the people in the first area of refuge to egress by both fire truck ladder and stairwell. In the US codes, there is no such requirement for refuge areas. Egress design is achieved by the egress zone, which is typically defined as the fire floor, the level below and the level above, which needed to be evacuated simultaneously. All the other floors keep

Oakland Federal Building. Courtesy RJA

High Rise Office Building Fire Protection

the concept of "defend in place" which in most situations is believed to be the correct approach. Since September 11, however, this concept is being discussed because of the implications that human behavior may cause the occupants to now evacuate all floors above the fire floor.

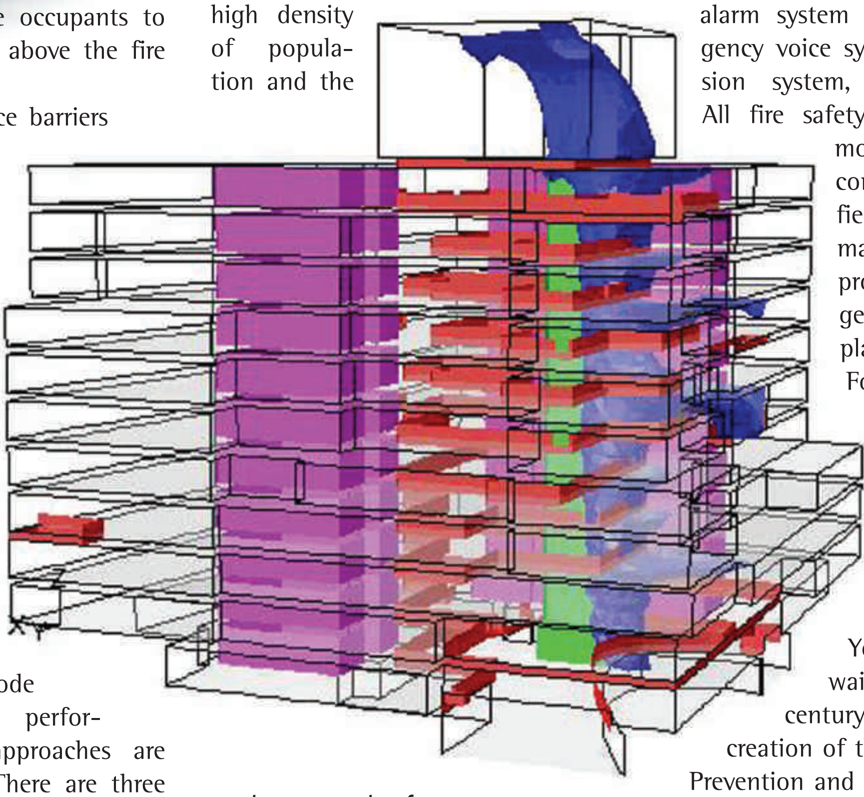
In its efforts to reduce barriers to international trade, the World Trade Organization (WTO) encourages the concept of international codes and standards. WTO compliant international standards development organizations include ISO, IEC and NFPA. Each of these organizations is including performance-based design criteria in their documents.

In support of these code development efforts, performance-based design approaches are being closely studied. There are three major tasks associated with this study:

- behavior of the building construction during fire exposure
- computer modeling to predict the smoke spread
- computer modeling to predict automatic suppression system actuation and fire control

Computational Fluid Dynamics (CFD) modeling has previously been used in high rise buildings for analysis of the effects of wind on the structure. CFD modeling is now also being used for the study of smoke movement in the building. The traditional method to predict the construction behavior by the small and large scale tests are not cost-effective and, as a result, much effort is being place of this modeling approach. The model gives us the capability, with real time visualization output produced from the fire models, to design the emergency smoke control system and evaluate the associated evacuation options. The egress model, Pathfinder, which has been developed by the engineers at Rolf Jensen & Associates is a valuable tool in conducting, verifying and demonstrating the egress analysis.

Even though the loss from September 11 may bring questions and concerns on the future for high rise buildings, there is no question that for some countries such as China, with the high density of population and the economic boom, high rise buildings will still be dominant in major cities. The collapse of the WTC bring us to the question of high-rise office building sprinkler systems and can they help maintain structural integrity in such an incident? The critical failure temperature for steel element is about 500-600ºC without any fire retarding treatment, and in most cases for a conventional fire, the sprinkler system would have been sufficient to control the fire size and allow for occupant egress. For office buildings, its fire load is generally defined as 2,000 btu/ft. The fuel load presented by the jet fuel in WTC was considerably greater than what the sprinklers could have been expected to control contributing to the fire growth and its great impact for the whole building construction integrity.



High rise graphic from RJA.

Most people agree that it is impractical to attempt to design a sprinkler system for a building to withstand the impact from a fully-fueled wide body jet. However, with an integrated performance-based approach to fire safety, performance objectives can be developed to meet the exposures the building may be expected to face.

An integrated fire protection system for a building should include the fire resistance rating for the assemblies, the fire stop system in curtain walls and rated assembly penetrations, the fire alarm system along with the emergency voice system, the fire suppression system, and egress systems. All fire safety systems need to be monitored at a fire command center by qualified personnel. A properly managed maintenance program and an emergency evacuation training plan are also necessary. For a good fire protection system, survivability and reliability should be inherent in the design.

We have always learned from fire disasters, such as the New York City Triangle Shirtwaist fire early in the 20th century which led to the creation of their first Bureau of Fire Prevention and the enforcement of fire safety codes for compulsory fire drills and the installation of sprinklers in factories. The MGM Hotel fire in Las Vegas demonstrated the importance of sprinkler systems together with an integrated fire alarm and emergency communications systems working with the emergency smoke control systems. The tragic events of September 11 should be another reason for all of us to think deeply on how to make our buildings stronger and our world safer.

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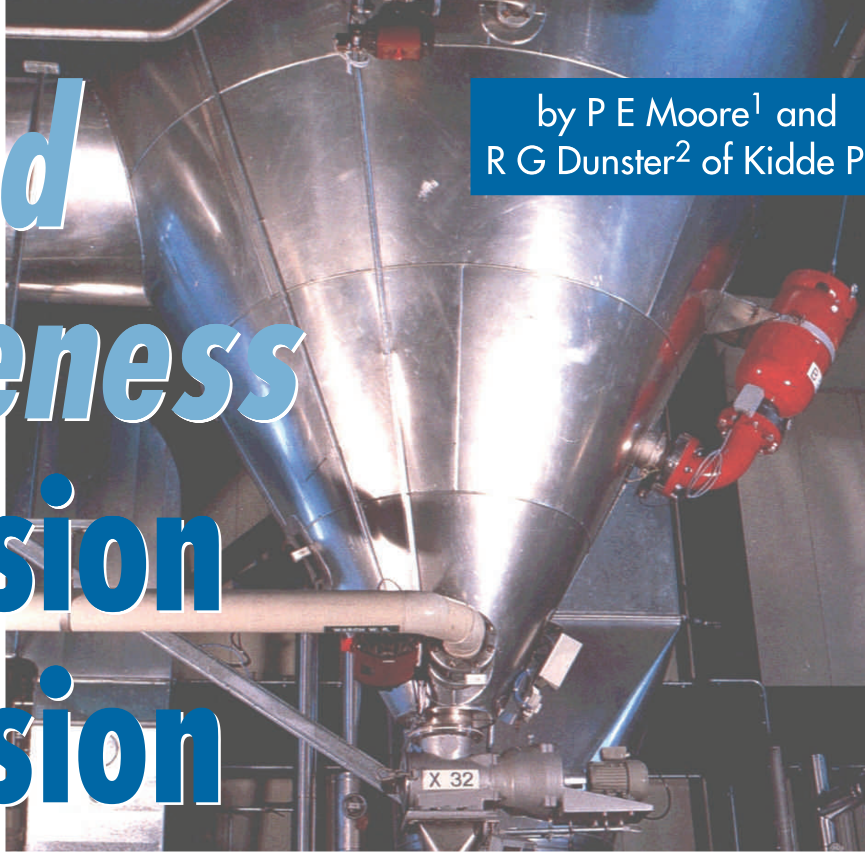
Improved Effectiveness in Explosion Suppression

by P E Moore[1] and
R G Dunster[2] of Kidde Plc



Typical spray dryer installation fitted with a Graviner explosion suppression system.

THE EFFICIENCY OF AN EXPLOSION SUPPRESSION SYSTEM to mitigate against the consequence of an explosion incident is quantified by a determination of the expected reduced (suppressed) explosion pressure, P_{red}, that is the result of a successful suppression. Factors that affect suppression system performance include:

- Explosion detection criteria
- Suppressant effectiveness
- The temporal and spatial deployment of the suppressant

This paper considers each of these parameters, and demonstrates how improvements in each of the above have lead to improvements in overall explosion suppression efficiency, and thus increased capability from explosion suppression technology.

Design engineers require a simple design methodology. Mathematical models have been shown[1] to provide a reliable projection of suppression system efficacy. Incorporation of the latest improvements in detection technology, suppressant technology, and suppressant deployment technology into a mathematical model provides for a design guidance tool that leads to enhanced explosion suppression capability. This paper demonstrates the practical implications of these enhancements.

Criteria for Suppression

The accepted hypothesis[2] of explosion suppression identifies that the deployment of a suppressant material into the propagating combustion wave of an incipient explosion reduces the combustion zone temperature to below a limiting adiabatic flame temperature such that combustion reactions cannot be sustained. This hypothesis identifies the requirement to deploy a minimum critical mass of suppressant into the enveloping fireball of the explosion to attain suppression – see Figure 1. If this criterion is not met the consequence will be a failed suppression – in which combustion is not effectively arrested and high explosion pressures must be anticipated.

This representation, which is based on classic thermal explosion theory, is an over-simplification. Whilst in dust explosions the system thermodynamics is the dominating influence on the suppression criteria, energy exchange is not instantaneous and the heat exchange kinetics influences the suppression outcome. Further, most proprietary suppressants have a chemical inhibition influence that is additive and thus enhances the suppression efficiency of the agents.

For most practical applications of explosion suppression it is necessary to determine the WORST CASE maximum suppressed explosion pressure, $P_{red,max}$, that can result for the identifiable explosion challenge. Provided that this suppressed explosion overpressure is lower than the process equipment pressure shock resistance, and provided further that suppression is achieved with a sufficient margin of safety, effective explosion protection by the explosion suppression system can be assured.

Recognition of the distinction between an effective suppression and a failed suppression is fundamental to ascribing the efficacy and limitations of any explosion

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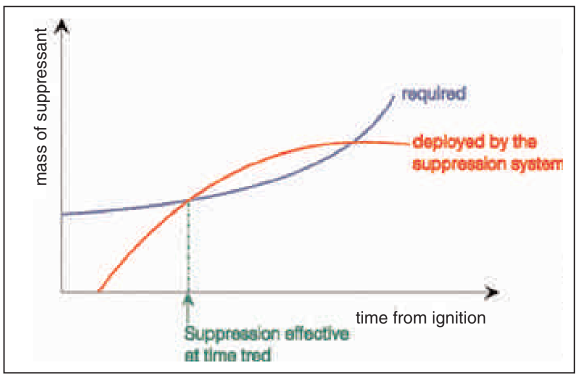

Figure 1: Design criteria for effective explosion suppression.

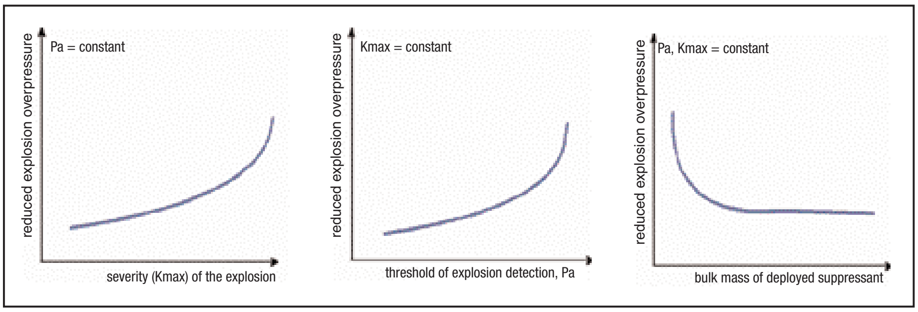

Figure 2: Key influences on explosion suppression system efficacy.

suppression system. For a given explosion suppression system (detectors, HRD-Suppressors[3], suppressant type etc.), regression from effective suppression to failure will result if:

- The explosion intensity is increased (higher P_{max} and K_{max})
- The suppression system detection criterion is desensitised (higher P_a)
- The rate of deployment of suppressant is reduced (lower propelling agent pressure) or the concentration of suppressant is reduced (smaller or fewer HRD-Suppressors)

These effects are shown diagrammatically in Figure 2.

Improvements in Suppression System Technology – Detection Technology

For dust explosions in closed vessels explosion detection is usually by either static threshold or dynamic explosion pressure detectors. Dynamic detectors were developed and introduced to minimise nuisance alarms arising from process induced pressure excursions. Operational experience has shown that such process induced pressure changes are liable to result in an unwanted activation of a static pressure threshold detector.

Dynamic detectors provide considerable performance benefits over the static threshold detector in industrial practice. Specifically they ensure reliable detection when a pressure impulse exceeds a preset pressure variance, DP, within a specific time interval, Dt, irrespective of the plant process condition. Such dynamic detectors have an upper static pressure threshold, $P_{a,max}$, to ensure that they provide an alarm to the timid explosion.

These influences are demonstrated by considering the calculated suppressed explosion pressure that will result from a proprietary explosion suppression system designed to provide explosion safety against an St2 limit dust explosion in a closed $5m^3$ vessel. For this comparison – see Figure 3 – the following typical detection criteria were selected:

Static threshold detector:
Activation pressure at P_a = 50 mbar g

Static threshold detector:
Activation pressure at P_a = 100 mbar g

Dynamic detector:
Activation at ΔP = 50 mbar g
(Preset upper threshold limit $P_{a,max}$ = 200 mbar a)

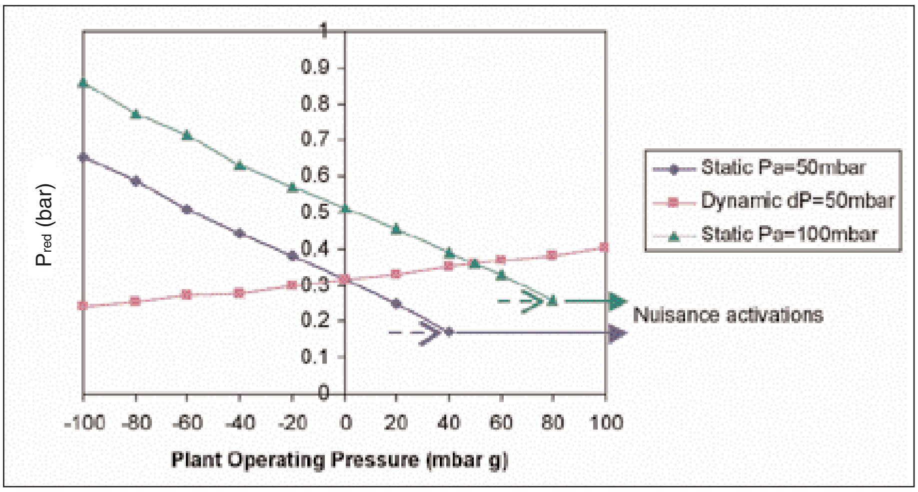

Figure 3: Projected influence of the plant operating pressure on the resultant suppressed explosion pressure for a proprietary explosion suppression system[4] with either static or dynamic detection against an St2 limit explosion in a $5m^3$ closed vessel.

A plastics silo protected by a 35kg high rate discharge suppressor.

Plant process pressure excursions below ambient result in a higher P_{red} with the static detector, but a lower P_{red} with the dynamic detector. Plant process pressure excursions above ambient result in a lower P_{red} with a static detector but threaten a nuisance activation – in practice where positive pressure excursions are anticipated the static threshold detector must be set to a higher pressure threshold, say P_a=100 mbar, and consequentially a higher P_{red} results. The influence of the plant operating pressure on the derived P_{red} for a dynamic detector is a consequence only of the influence of the initial pressure on the resultant explosion intensity. The option to select a lower DP for the dynamic detector will result in improved performance relative to the datum above.

Improvements in Suppression System Technology – Suppressant Effectiveness

In absolute terms, the effectiveness of any explosion suppressant is a function of:

- thermodynamics – the higher the heat extraction capacity the better
- kinetics – the faster the energy exchange the better
- chemical specificity – the greater the chemical inhibition of the combustion process the better.

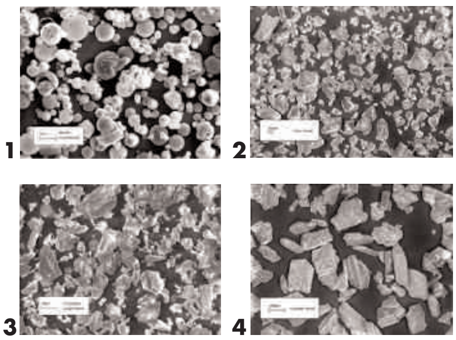

Figure 4: Electron micrographs that demonstrate the differing size of bicarbonate powders manufactured by spray drying, or by grinding.

[3]HRD-Suppressor or high rate discharge suppressor in the context of this paper refers to a stored pressure container, suppressant charge, valve and valve opening mechanism, dispersion spreader and fittings.
[4] Suppression System: 3 x 4kg/75mm HRD-Suppressors, Suppressant: Dessikarb, P_s=60 bar

Suppressant	Median Particle Size µm	Extinguishing Efficiency Mass Equivalence
1. Aerosol $KHCO_3$	7	0.15
2. Fine Grind $NaHCO_3$	27	0.9
3. Proprietary $NaHCO_3$	–	1
4. Coarse Grind $NaHCO_3$	150	10.2

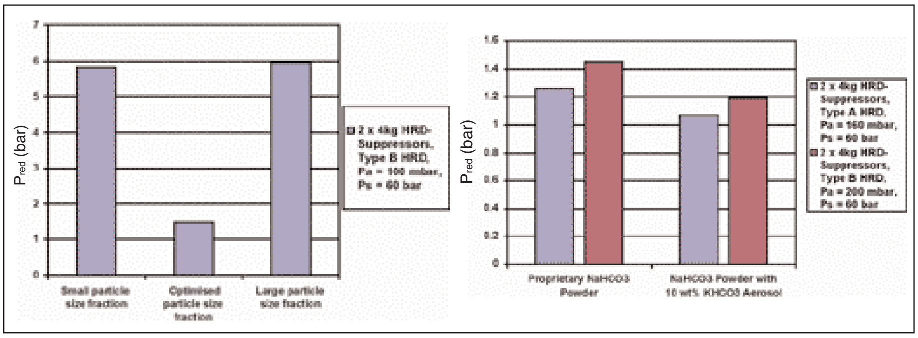

Figure 5: Explosion suppression tests against a $6.2m^3$ St1 limit dust explosion that demonstrates the influence of particle size distribution.

The physical characteristics (droplet size/size distribution or particle morphology/size distribution) have a very significant influence on flame extinction efficiency. Literature (3,4) teaches us that finer droplets or smaller particles are more efficient, and that for powders a high specific surface (irregular particle shape) is more efficient. Figure 4 shows electron micrographs of $KHCO_3$ manufactured by a spray drying process and of three $NaHCO_3$ samples manufactured by a grinding process.

Clearly the particle size of the spray-dried product is much finer. Measurement of the extinguishing efficiency of these agents against small-scale laboratory fire tests (4) demonstrates that the finer particulate powders are more efficient extinguishants than the proprietary powder.

However, realising this benefit in the practice of an explosion suppression system design is not that simple. In deployment finer powders have less momentum – therefore they are less able to be deployed in large spaces, and are more likely to be swept away from the combustion zone by the expanding combustion gases. Comparative explosion suppression tests in a 2:1 aspect ratio $6.2m^3$ vessel against an St1 limit maize dust explosion demonstrates this influence.

It is an inevitable consequence that the particle size distribution needs to be optimised for the explosion suppression system hardware to maximise system performance. An optimised explosion suppressant has the characteristics of providing sufficient large particles to entrain the smaller particles as the suppressant cloud is deployed from the nozzle towards the enveloping fireball.

Suppressants that have a decrepitation feature – that is they are deployed with a fairly large particle size distribution but the particles decrepitate into many smaller particles as they come in contact with the flame – can be better explosion suppressants. Figure 6 contrasts the suppression efficiency of a mono-ammonium phosphate suppressant with that of a potassium allophonate suppressant. The latter suppressant has a larger median particle size but is more efficient because of its decrepitation properties.

Mono-ammonium phosphate (MAP) – median particle size = 36 mm

Potassium allophonate – median particle size = 44 mm

The chemical specificity of the suppressant against the specific explosion risk needs to be understood. Water has a proven effectiveness as an explosion suppressant against hydrophilic dust explosions where the combustion mechanism is dominated by heat transfer, but is much less effective against homogeneous flammable vapour explosions (5). If some chemical specificity is attained by the addition of an appropriate chemical species, much improved suppression is achieved. The results of explosion suppression trials against explosions of a turbulent spray cloud of cooling oil in a $6.2m^3$ vessel demonstrates this influence – see Figure 7.

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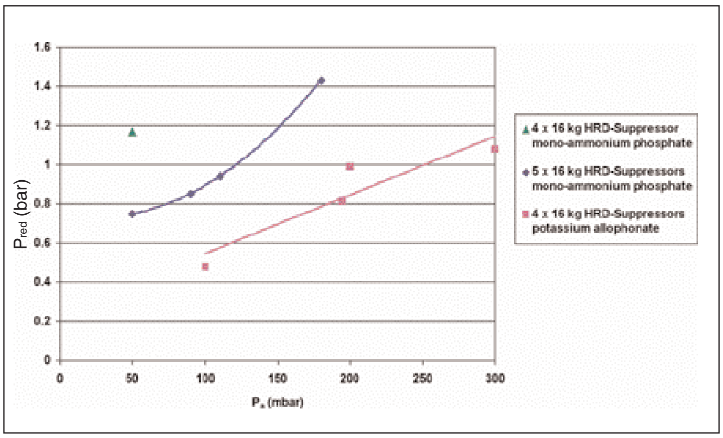


Figure 6: Explosion suppression tests against a $25m^3$ St2 limit dust explosion that compares the effectiveness of a conventional MAP based suppressant with a proprietary suppressant that exhibits decrepitation.

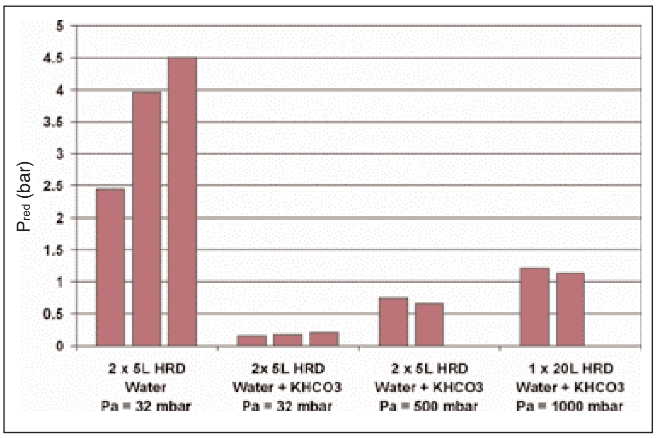
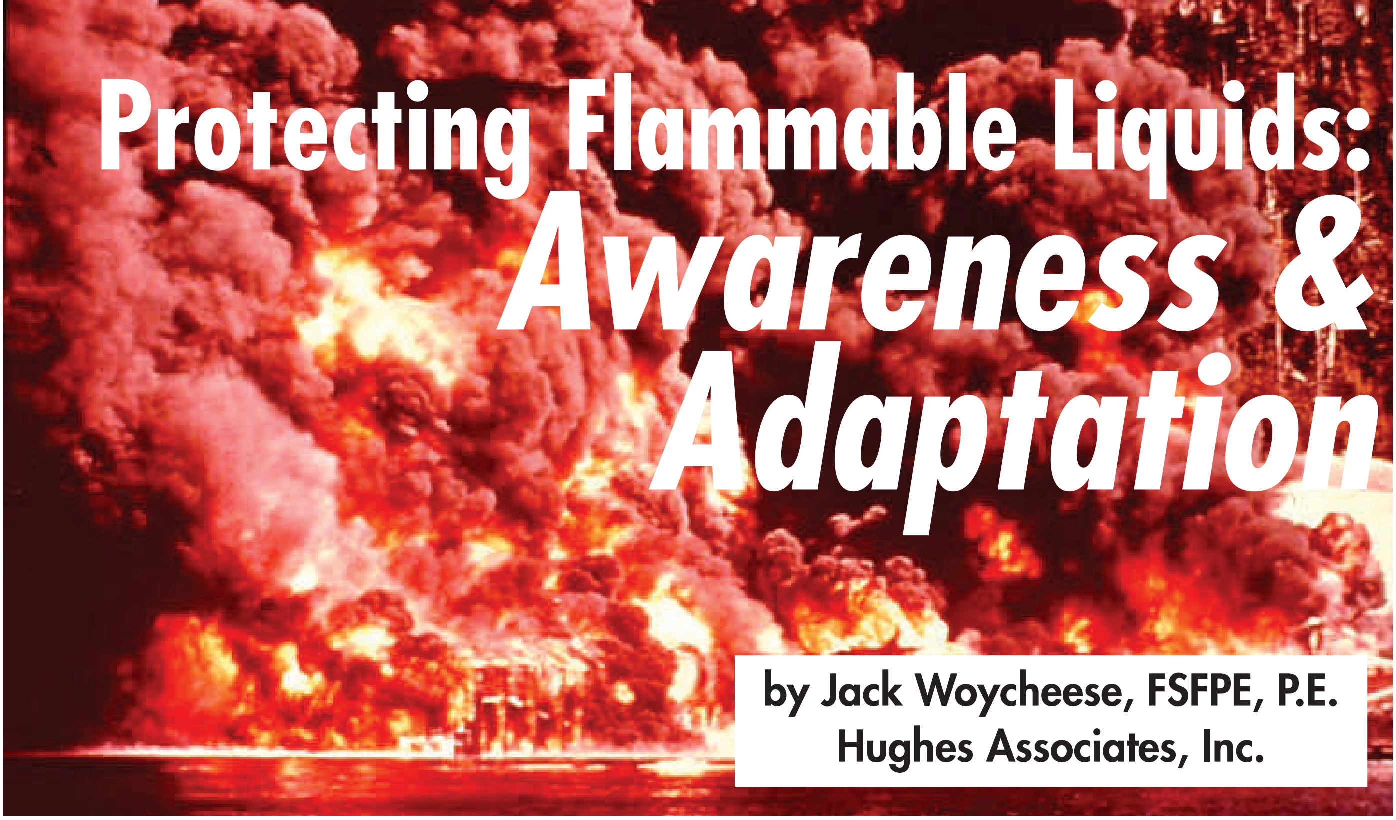


Figure 7: Explosion suppression tests against a $6.2m^3$ fuel spray explosion that demonstrates the benefit of adding chemical specificity to water in order to attain suppression of this explosion scenario.

Protecting Flammable Liquids: Awareness & Adaptation

by Jack Woycheese, FSFPE, P.E.
Hughes Associates, Inc.



Hydrocarbon Fire.
With permission of National Fire Protection Association

In the recent best seller, *Who Moved my Cheese?*, Spencer Johnson, M.D., presents a parable to illustrate change, the reasons behind change, and varied reactions to change. We draw the conclusion that awareness and adaptation are among the keys to survival.

The flammable liquids and petrochemical industries are aware of the changing business environment. Let's look at adaptations of these industries over the past 15 years and the changes they have weathered:

- Experienced workers have retired and, through this attrition, the average experience level has decreased.
- The number of employees – administrators, operators, maintenance personnel, and inspectors – has decreased in response to reduced market conditions and resultant lower margins.

At the same time, plants, once located in the proverbial boondocks, now find that they have new neighbors. These neighbors question the wisdom of locating refineries and petrochemical plants adjacent to schools and housing – ignoring the fact that the plants preceded local growth and encroachment.

Add to the mixture the well-documented results of such issues as:

- Cyclohexane at the Nypro plant at Flixborough, UK in 1974
- Methyl isocyanate at the Union Carbide plant in Bhopal, India in 1985
- Paint-products pollution from the Sherwin-Williams Paint Warehouse Fire, Dayton, Ohio in 1987
- Pesticide-contaminated firewater at the Sandoz Chemical Plant Fire, Basel, Switzerland in 1986

and you make a strong case for responding to change in a positive and effective manner.

REACTIONS TO CHANGE

As a result of reductions in personnel, the approach to routine operations, maintenance, and inspection has changed.

- Process controls are now automated by computer to enable fewer people accomplish the work of formerly great numbers of employees.
- Participation by industry in the codes and standards process has decreased as budgets and manpower issues force more focus on the daily production requirements.
- Maintenance databases, reliability data, and probabilistic approaches have reduced levels of inspection and maintenance.

INDUSTRY AND GOVERNMENT RESPONSE

The concerns about the effects of products of combustion or chemical releases on the nearby public, combined with the aforementioned incidents, sent a wake-up call to flammable liquids industry to focus on public safety.

Industry and governments responded with mandates for more rigorous methods to incorporate fire safety elements properly into design and operations and to document these elements preparatory to facilitate audits for acceptability.

The American Petroleum Industry prepared a program, published as *API Recommended Practice 750, Management of Process Hazards*. This recommended practice essentially parallels similar programs from several professional organizations: the U.S. Occupational Safety and Health Agency – *Process Safety Management of Highly Hazardous Chemicals*, the American Institute of Chemical Engineers' Center for Chemical Process Safety's *Process Safety Management*, and CONCAWE's *Methodologies for Hazard Analysis and Risk Assessment in the Petroleum Refining and Storage Industry, Report No. 10/82*, and the NFPA 30 *Flammable and Combustible Liquids Code Section 5.12, Management of Fire Hazards*.

Each of these programs contains the same basic principles, recommended for incorporation into plants' fire safety programs and listed alphabetically below:

Flixborough works after explosion, seen from north from The Flixborough disaster, Report of the Court of Inquiry, London: Her Majesty's Stationery Office, 1975.

- Assurance of the quality and mechanical integrity of critical equipment
- Audit of process hazards management systems
- Emergency response and control
- Investigation of process-related incidents
- Management of change
- Operating procedures
- Pre-start-up safety review
- Process safety analysis
- Process safety information
- Safe work practices
- Training

IN THIS ARTICLE...

While we cannot address all elements of fire safety design and operations in this article, we will look at changes to some of them, which are currently generating interest: system safety, training, performance-based design, water mist, emergency response planning (ERP), and Class B firefighting foam.

SYSTEM SAFETY

The proper and continuing application of the elements of *Management of Process Hazards* (MPH) to any plant's fire safety program not only provides essential information about the weaknesses in the plant's design and operation, but also establishes a firm basis for employee training and understanding.

This MPH supplements the old, but tried and true mantra that we must focus not on the worst-case scenarios, but rather on the *prevention* of such scenarios. We must assure that knowledgeable, trained, and experienced people design, construct and inspect, maintain and operate plants and facilities so that any releases are minor and easy to control.

From a fire protection standpoint, to keep releases to the minor level, we must assure that the design allows for:

- Rapid isolation and shut down, with adequately designed drainage and pressure relief
- Fire suppression systems to protect against fire exposure to flanges and other sources of additional release of flammable materials

Such an approach helps to minimize the spread of fire and to prevent major damage to valuable equipment, structural supports, instrumentation and cable trays, or other essential elements of the plant.

Recently, we have demonstrated that applications of MPH even to relatively small operations are valuable to management, operations personnel, and the public. One application involved a transit system's new liquefied natural gas (LNG)/compressed natural gas (CNG) storage and bus refueling facility. Results provided authorities and operations personnel with a level of comfort about the new technology.

TRAINING

According to MPH, training of employees may be based on codes, standards, regulations, and operating procedures to assure that those employees gain a fundamental understanding of the process and the safe operation, inspection, and maintenance of the process.

API RP 750 states that the training must be conducted:

- Initially, to assure that persons assigned to operate the facility have the required knowledge and skills to carry out their duties and responsibilities, not only during normal operations, but also during start up and shut down

- Periodically, to assure understanding and adherence to current facility operating procedures, and whenever equipment, procedures, or personnel change

Owners must document training as part of the preparation for required audits, which verify that plant owners are administering the program properly. New web-based programs enable owners to more easily and cost-effectively provide and document the required training, including tests of proficiency.

An additional benefit is that these test results may help to identify and qualify participants for higher paying positions and increased responsibilities.

PERFORMANCE BASED DESIGNS

Codes and code authorities are increasingly accommodating performance based designs. The new International Building Code, the new International Fire Code, the developing NFPA 5000 building code, and the NFPA 30 Flammable and Combustible Liquids Code have added wording to facilitate the application of performance based designs in those circumstances under which prescriptive designs are not readily applicable.

As society increasingly encroaches on the plot limits of plants, performance based designs have become a means of rationalizing spacing for new and existing facilities. Modeling of releases, pool fires, radiant heat levels, flammable vapor cloud travel, blast effects, and BLEVE (Boiling Liquid Expanding Vapor Explosions) effects from reasonable incident scenarios enable greater technically based scrutiny of plant exposures.

Modeling has become more comprehensive, with impressive graphical displays illustrating what once required reams of computer paper. We have also become increasingly dependent on computer validation of our conclusions and decisions. Although these models now show results in a much more user-friendly format, the limitation of any computer program is, of course, that someone must enter the proper data correctly and into the correct model.

Unfortunately, owing to the many demands on governmental monies, organizations such as the U.S. National Institute of Science and Technology are struggling to fund such efforts to validate computer models. We do need this research to build the confidence of the public and authorities in the calculated analyses of releases.

WATER MIST FIRE PROTECTION SYSTEMS

The flammable liquids industry is now adapting water mist fire protection systems to protect flammable hazards. On Alaska's North Slope, water mist systems are replacing Halon 1301 in new construction of gas compressor modules, turbine enclosures, NGL pump rooms, and chemical injection skids. The hazards in these modules include fire in lubricating oil systems for the turbines, compressors, and pumps. Fuel may release as atomized sprays, creating spray fires, or as liquid spills, creating pool fires.

Water sprays from standard sprinklers or badly managed hose streams cannot extinguish spray fires. Water sprays could, however, agitate the fuel surface of pool fires and intensify burning, a problem that does not arise with properly designed water mist.

The major benefits of water mist arise from oxygen displacement by water vapor, and radiation attenuation. In machinery enclosures, however, other mechanisms combine to contribute to fire control:

- Flame cooling
- Cooling of vital equipment
- Cooling the fuel below its vaporization temperature
- Vapor dilution

In addition to controlling lubricating and fuel oil fires, water mist has potential benefits for mitigating the hazards of gas releases. Pre-emptive application (i.e., injecting mist before ignition) of a water mist system can increase the energy required to ignite released gas. Increasing the ignition energy is

equivalent to increasing the lower flammable limit of the released gas.

DESIGN CONSIDERATIONS

Careful design of water mist systems is essential to assure that the characteristics of the system (e.g., droplet size or pressure) do not inadvertently add to the post-release risk.

Some water mist systems cycle the spray on and off and include a built-in off cycle, lasting as long as three minutes.

- For pre-engineered systems *identical to the FM test basis of the listing*, the three-minute off cycle might be appropriate.
- Where conditions differ from the listing basis, such as larger volume spaces, the potential for gas release, or the proximity to heat-sensitive control equipment, the three-minute off cycle is unacceptable.

We must understand how the water mist system will perform in a particular application. When selecting the minimum duration of discharge for water mist, system designers must consider such elements as the time required for turbine coast-down, emergency shut down and response.

In the ever-growing number of FM and UL listings for water mist systems, field applications inevitably vary from the listing. Water mist system designers must judge when they can safely extrapolate design criteria from the listing. For that reason, the vendor, designer, owner, and authority having jurisdiction must discuss the design of water mist for fire protection. Owners and authorities should require a technical review as assurance that extrapolation of test data is technically acceptable and that the system may be reasonably expected to provide the desired protection.

EMERGENCY RESPONSE PLANS

Emergency response planning has even greater importance today than in years previous.

Encroachment has reduced the safety factor for response. The time allotted to conduct an emergency shut down has created even greater pressure on the operator responsible to do so. If s/he errs by not shutting down when appropriate, the public is endangered. If s/he errs by shutting down when inappropriate, s/he creates an economic burden on the employer and company shareholders. To compensate for this situation, companies have turned again to basics, supplemented by modern technology.

To gain a better understanding of the limits of operations and the incidents that may occur, plant workers apply process hazard analysis techniques, such as hazard and operability (HAZOP) studies and failure mode and effects analysis reports. Modeling helps provide an understanding of the potential consequences and the time available to respond to a release.

In one community, the petrochemical industry funded a sophisticated, integrated, neighborhood warning system to alert plant personnel, emergency responders (fire department, police department, environmental health organizations, government agencies, etc.), and nearby citizens. Designed to provide information to all concerned about the incident and the proper response to it, the system involves sirens, telephone call down systems, public radio and television, highway electronic signage, radios in hospitals and similar public areas, and even car radios.

To improve the efficiency and effectiveness of emergency response, some companies set up exercises, based on possible incidents. These simulations are beneficial and include *what if* drills, tabletop exercises, limited full-scale drills, and full-scale drills involving the community and mutual aid organizations.

Almost axiomatic in the analysis of response to actual emergencies is the primary criticism about difficulties resulting from a lack of communication during an emergency. To improve communications, many companies have established well-developed command centers where company management and key personnel gather. These rooms are equipped with everything needed to assist the Incident Commanders when

responding to an incident. The companies also establish a process to review, test, and update all tools and information in the room routinely. Some of the materials and equipment include:

- A well thought out, up-to-date, and documented emergency response plan, identifying responsibilities, personnel, and probable steps during a disaster
- Televisions and radios to monitor public broadcasts
- Computer systems and backups
- Facility site plans
- Models of releases
- Process piping and instrument diagrams
- Process flow diagrams
- Fire water system drawings
- Emergency telephones
- Mobile phones
- Multiple two-way radio networks

Successful implementation of the plan is a function of training and drills, which must include all stakeholders who may become involved in the response.

In the best case, companies integrate response plans into multi-hazard plans and corporate business continuity plans. In some cases, companies also establish and maintain alternate remote control centers.

CLASS B FIREFIGHTING FOAM

The 3M Company recently reduced the arsenal of firefighting weapons by deciding to stop manufacturing Class B firefighting foam, including Light Water™ aqueous film-forming foams (AFFF) and alcohol type concentrate (ATC). They based their decision on environmental concerns about biodegradation products from 3M's fluorochemical surfactants, produced by the electrochemical fluorination manufacturing process.

The biodegradation product (perfluorooctane sulfanate, or PFOS) from 3M's fluorochemical surfactants **does not** meet U.S. Environmental Protection Agency environmental objectives =relating to PBT: persistence (does not dissipate in the environment), bioaccumulation (builds up in living tissue) and toxicity (has a negative affect on organisms). As a result of data about issues with PBT and potential future regulations/restrictions, 3M decided to stop manufacturing foam.

Other suppliers of foam derive fluorochemical surfactants from a different manufacturing process, telomerization. Concerned that telomer-based products may also be PBTs. The U.S. EPA is, however, currently performing a hazard assessment of telomer-based chemicals and their biodegradable products.

Those involved with flammable liquid fire protection should continue to be well informed about the environmental status and any attempt to limit the availability of foam. Foam is a major tool in the firefighting arsenal for hydrocarbon fires and potential future restrictions could have significant impact on fire protection.

SUMMARY

Over the years, changes in the flammable liquids and petrochemical industries have affected the approach to fire protection. Reductions in manpower, budget, and experience levels and the encroachment of society on hydrocarbon facilities changed protection.

Flammable liquids and petrochemical industries are placing greater emphasis on a systems approach to fire safety, MPH, training tools and emphasis, performance based designs, water mist fire protection systems, emergency response plans, new concerns about firefighting foam, and environmental considerations in firefighting.

We expect computers to facilitate decision-making during an emergency and to minimize the effect of an incident. Electronic tools also manage changes to our designs, operational controls, training of personnel, and safe shut down of facilities under emergency conditions.

We have come far in the past few years and must be ready to continue our contributions, awareness, and acceptance of change and improvements in the protection flammable liquids.

Jack Woycheese, P.E., FSFPE, a senior fire protection engineer with Hughes Associates, Inc., has experience in the hydrocarbon and petrochemical industries in Alaska, Canada, Dubai, Indonesia, Saudi Arabia, and the United States. He also represents Hughes as vice president of international business development.

Mr. Woycheese holds a BSc in Fire Protection Engineering from Illinois Institute of Technology and a Masters in Business Administration from Northwestern University. He is a former president of SFPE, chairs the NFPA 30 (Flammable and Combustible Liquids Code) Technical Committee on Operations, and is a principal member of NFPA 30 Technical Correlating Committee.

Mr. Woycheese is a Registered Professional Engineer in California, Illinois, and the Republic of Korea.

For additional information about Hughes Associates, Inc., please visit the website at www.haifire.com.

Developments in Portable Fire Extinguishers

Fryer Fire. Pic: courtesy of Chubb

BSI Kitemark Licence No KM 06962
PORTABLE EXTINGUISHER MANUFACTURE: BS EN 3

Certificate No. FS533
PORTABLE EXTINGUISHER MAINTENANCE: BS 5306 Part 3

by CHUBB FIRE

IN A SURVEY OF THE USE OF FIRE EXTINGUISHERS carried out in the UK in 2000 it was found that in 80% of the cases surveyed, a portable fire extinguisher had been used to put out the fire in its incipient stages. Small fires had been prevented from becoming large ones. In the vast majority of cases the local fire brigade was not called or involved, the fires were dealt with effectively and presumably the business or person concerned dealt with any resulting damage privately or through an insurance company. Such incidents therefore did not officially happen. They were not recorded in any official statistics of fire occurrences and similarly their causes went unrecorded.

That tends to be the lot of the fire extinguisher. For most of its working life it remains in one position, is ignored by most and only when there is a fire incident will anyone think about it. But when that incident occurs then of course it must work correctly first time.

Now even more than before the installation of fire extinguishers in commercial and industrial premises is under threat. In the UK we have seen the stated intention of a major national Housing Association to remove all of its fire extinguishers from its premises and others may follow. We have seen the policy declaration of a leading warehousing and distribution company that it will in effect let its buildings burn down as long as the occupants can be evacuated in time. Is this really a responsible attitude to fire safety or just a short term way of saving money?.

There is real fear among fire industry professionals that the good work in improving fire standards in the UK built up over many years since the introduction of the Fire Precautions Act 1971 are now being eroded because of the change in responsibilities brought in with the Fire Precautions (Workplace) Regulations 1997 as amended. Employers and those responsible for the safety of their employees and others from fire are seeing an opportunity to save some money and cut back on their fire precautions, backed no doubt by the evidence of a fire safety record in the UK which has been extremely good. Time will tell what effect such actions will have on that previously excellent fire safety record.

Not only is it in the UK that there is growing concern about the new goal based approach to fire safety. In France, Germany, Holland, Austria and many other EU countries similar experiences are being recorded. It would be sad indeed if it took a major fire incident and loss of life to raise the awareness of deteriorating fire safety standards.

Portable fire extinguishers have been developed over many years and although the technology is not the most fast moving, there have been significant improvements in recent years to make them more efficient, easier to use and handle. The goal of finding one extinguisher type that will deal effectively with any type or class of fire still has not been achieved and probably never will be, but now for all classes of fire there is an extremely effective extinguisher or combination of extinguishers available.

Recent developments have been in the addition of additives for water extinguishers to make them more efficient and to enable the amount of extinguishant to be reduced. What was considered the industry standard – the nine litre water extinguisher – has been all but replaced by six litre or even three litre water with additive extinguishers. These pack the same fire fighting punch as the

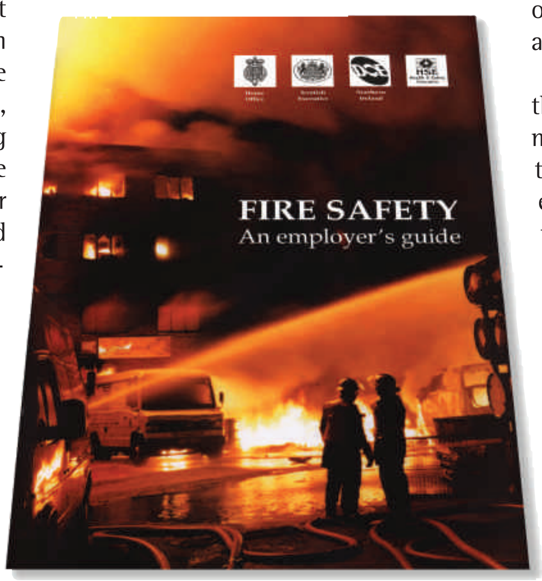
Welder using Halon extinguisher.

old nine litre products by making the water "wetter" and allowing it to flow more effectively over the area of the fire. Imagine how much easier it is to use an extinguisher that is only two thirds or even one third the weight of the old one.

The demise of extinguishers containing halon (BCF 1211) brought about finally by the European Regulation EC2037/2000 has taken away from the fire industry one of the most efficient, effective and cleanest means of fighting fire that has ever been devised. By the end of this year no halon extinguisher may be refilled if discharged. By the end of 2003 across Europe all such extinguishers must be withdrawn from use, except in a very few identified critical uses, and the halon either recycled or destroyed. One alternative to halon is ABC dry powder. But dry powder has significant disadvantages, particularly in its poor Class A fire fighting performance because of its lack of cooling properties, the obscuration it causes when used in confined places and the residual mess and clean up required.

The most recent development has been the introduction of extinguishers that contain a "wet chemical" formulated specifically for use on cooking oil fires. Acknowledged as one of the most difficult fires of all to put out because of the very high temperature at which it burns, the cooking oil or chip pan fire can now be dealt with very effectively by this extinguisher. Previously the preferred method of dealing with a cooking oil fire was to use a fire blanket or – even scarcely believable – a wet tea cloth. Both methods involve getting very close to a very hot fire and in some cases the effectiveness of blankets has been seen to be less than acceptable allowing the fire to break out again from under the blanket. The wet chemical extinguisher has none of these problems and very large commercial deep fat fryers can be protected very effectively with a relatively small (6 litre) extinguisher. No other type of extinguishant has proved capable of consistently putting out the cooking oil fire. In the UK a new fire classification for cooking oil fires (Class F) has been introduced but is yet to be included in the European Norm EN3. Such extinguishers contain a wet chemical agent which is typically based on citric or lactic acid which when applied to a cooking oil fire has the effect of turning the oil in to a soap-like substance, completely sealing off and smothering the fire.

Foam extinguishers are normally filled with a solution of Aqueous Film Forming Foam (AFFF). They are equally effective on both Class A and Class B fires but in recent years the AFFF itself has come in for some criticism because it is not very friendly to the environment containing as it normally does heavy salts which can cause problems if accumulated in the run-off from fire fighting operations. There has therefore been a move to introduce biologically friendly products that largely solve this problem.



Fire & Safety Guide. Courtesy Chubb Fire

The problems of dealing with fires involving a live electrical risk still persist. Although as part of the testing procedure contained in EN3 an extinguisher must meet the requirements of a 35kV dielectric test, manufacturers are very reluctant to state unequivocally that their "wet" ie water, foam or wet chemical extinguishers are safe to use on such fires. Even though the likelihood of an electrical shock problem is very small indeed, the fear that an incident could happen and injure or even kill the person using the extinguisher is seen to be too great a risk for most. CO_2 therefore remains the preferred extinguishant for electrical risks even though new gases have been developed, some as streaming agents applicable to portable fire extinguishers, but so far performance and cost considerations have not allowed them to become commercially viable.

Compliance with the Pressure Equipment Directive (PED) in Europe is mandatory from the end of May 2002. This means that all extinguishers manufactured in the EU from that date must comply with the PED, be tested to the relevant harmonized standard and be CE marked. The purpose of CE marking is to remove barriers to trade across the EU and to facilitate the creation of the single market in Europe. Theoretically therefore this will allow extinguishers produced in one country in the EU to be legally sold in any other country without the need for further testing. However the proof of the pudding will be in the eating and time will tell whether the implementation of the PED will be trouble free and applied consistently across Europe.

One concern about CE marking is that it will come to be recognised as a mark of quality. Certainly in the case of the PED, extinguishers will only be tested to ensure that they meet the manufacturing safety requirements of the harmonised standard (hEN3). The performance requirements set out in the standard will not be considered or tested for CE marking purposes and therefore it would be possible for an extinguisher to comply with the manufacturing requirements but fail the performance (fire rating) criteria for example. The test house and certification bodies will need to be vigilant that false claims of performance are not made based on CE marking alone and that they take strenuous action to protect their quality marks and ensure that the distinction between a CE Mark and a Quality Mark are understood.

The portable fire extinguisher has been around for nearly a hundred years. It may not be the most technically advanced piece of fire fighting equipment but it has stood the test of time, is of proven worth in dealing with small fires and is simple to use. It would be a pity to forget this – as well as possibly a false economy – in the quest to save a little money from the corporate budget.

NFPA World Safety Conference & Exposition

May 20th – 22nd 2002 Minneapolis Convention Center, USA

Welcome to IFP's NFPA World Safety Conference & Exposition preview. For those of you who are going to attend the show, please read through our list of exhibiting companies. You will find information about who they are and what they will be exhibiting at the show. You will also see the floor-plan of the Minneapolis Convention Centre which is full to bursting with over 250 exhibition booths, displaying a vast array of both passive and active fire protection equipment and services. Keep this plan with you to help you find your way around.

For the serious fire protection professional there can be no better show to visit than the NFPA, where all of the world's leading suppliers to all market sectors will be present. For more information about the conference programme or exhibition please contact

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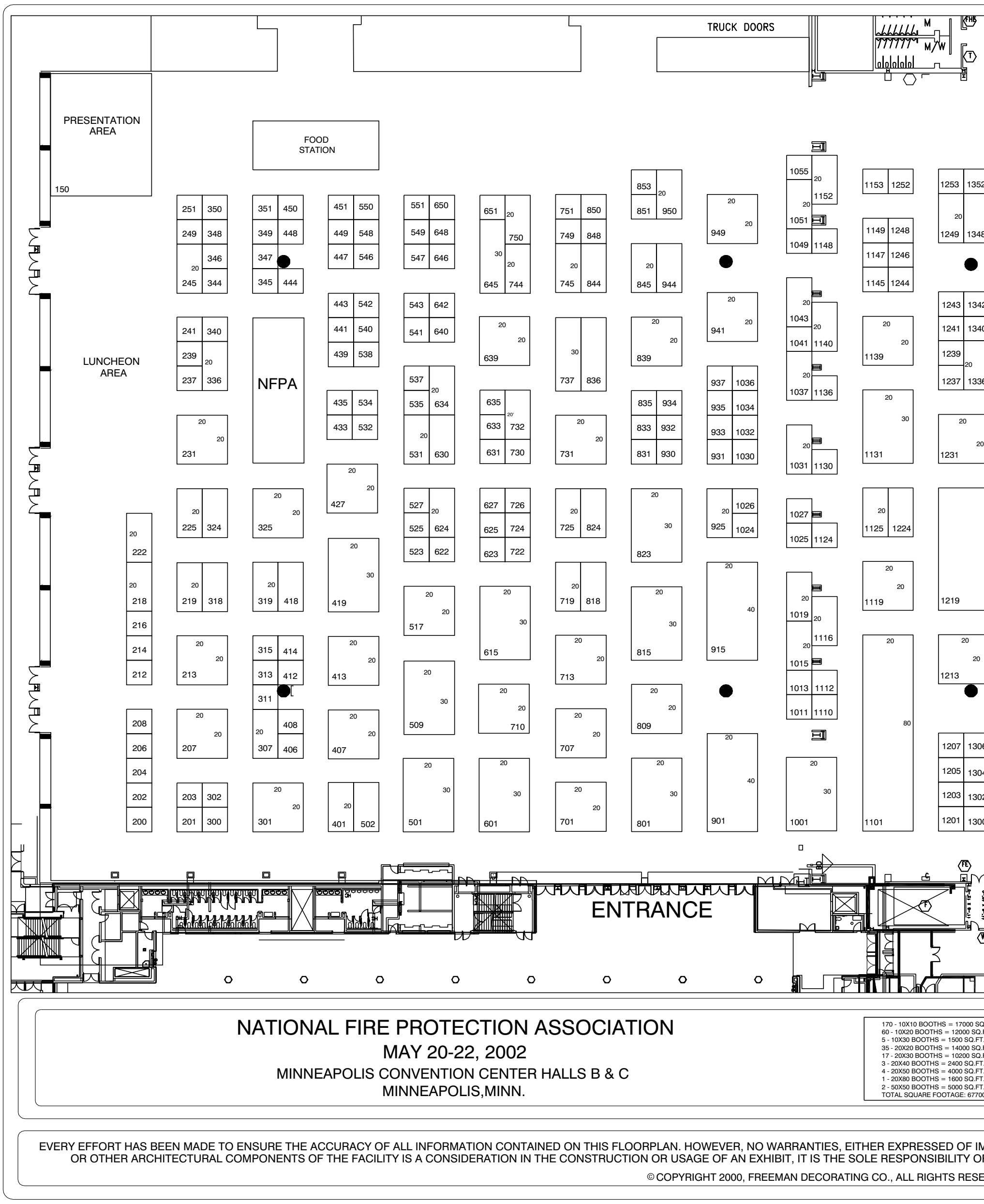
Or check out the website **www.nfpa.org**



AMERICAN PACIFIC CORP. HALOTRON DIV

Booth 1448

HALOTRON™ I, a clean replacement agent for Halon 1211, is available worldwide for use in fire extinguishers, aircraft rescue and fire fighting vehicles, and limited flooding applications. It is UL-approved and ULC-listed for use in extinguishers by Amerex, Badger, Buckeye, and Kidde and is approved by the EPA SNAP list for commercial, industrial, maritime, and military use. It is also used by the U.S. Coast Guard and for airport fire fighting (FAA). Visit us at www.halotron-inc.com.

AURORA PUMP COMPANY

Booth 427

Aurora Pump is exhibiting a complete line of fire protection pumps, including split case, in-line, and vertical turbines. They also feature a "Red Hot" Quick Ship Program and new stackable jockey pumps.

BUCKEYE FIRE EQUIPMENT CO.

Booth 325

Buckeye Fire Equipment Company is an internationally known manufacturer of fire extinguishers, fire fighting foam, foam equipment, and engineered foam systems, as well as dry chemical, Halotron, and carbon dioxide wheeled units. Stop by the Buckeye booth and pick up our literature. Be sure to ask for a copy of the Chevron/API foam test results–Buckeye's foam ranked highest.

CEASE FIRE LLC.

Booth 408

Cease Fire manufactures truly modular extinguishing systems able to adapt to changing requirements and function even during extended power outages. They are simplified in design and easy to install and maintain. All products incorporate patented CF33 gelled powder and an EPA-approved gas. Licenses are available worldwide, and Factory Mutual approval is currently in progress. Dealers wanted!

CHEMETRON FIRE SYSTEMS

Booth 1401

Chemetron Fire Systems™ (and its predecessor company, Cardox®) has been in the special hazards fire suppression systems business since 1939. Currently we offer systems utilizing:

Carbon Dioxide (CO_2) – both high pressure (cylinder storage) and low pressure (bulk liquid storage)

FM-200® – a gaseous agent for protecting normally occupied spaces and the most widely used Halon 1301 replacement

Argonite® – an inert gas mixture of nitrogen and argon that is also used in the protection of normally occupied spaces

Water Mist – a limited water supply is discharged under high pressure to produce a very fine water spray; uses significantly less water than a standard sprinkler system.

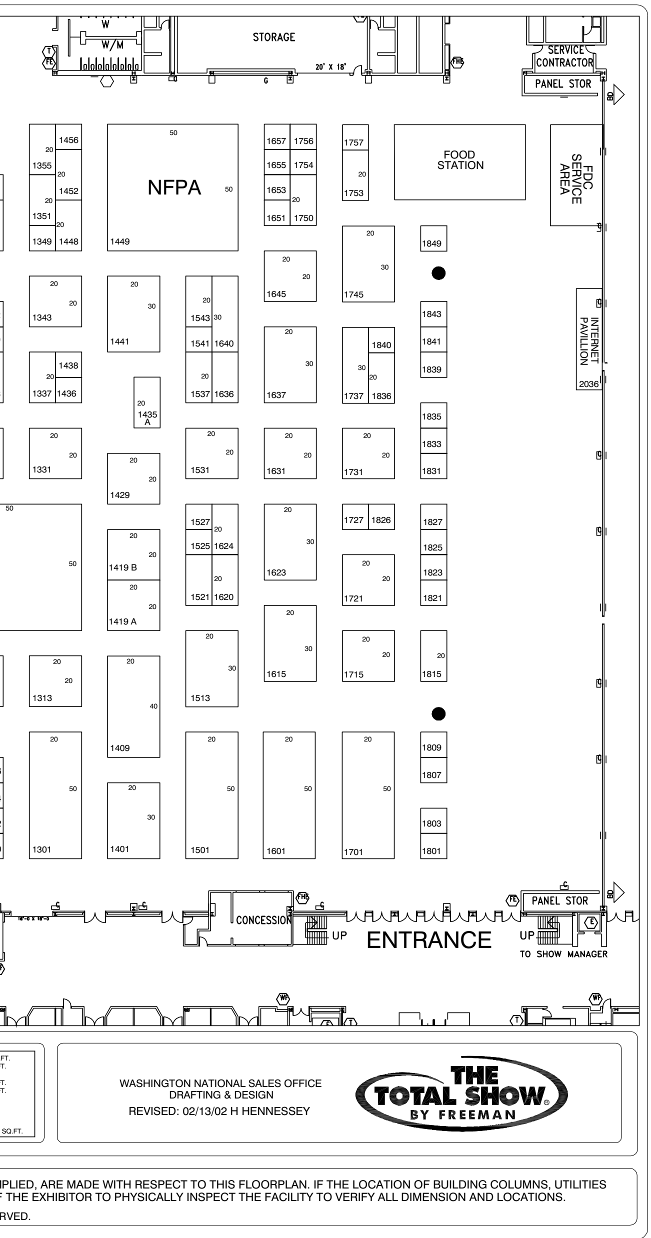
CLASS – Chemetron Laser Air Sampling System – The CLASS detector, with dynamic sensitivity range of 0.00075% to 0.3%, is designed for early warning smoke detection applications such as telecommunication facilities, data processing facilities, museums, and warehouses.

CHEMGUARD, INC

Booth 0744

During the NFPA World Safety Conference & Exhibition in Minneapolis Chemguard will introduce fluorosurfactant free foams (FSFF agents). These new agents do not form films on cyclohexane as do AFFFs. The new products promise to revolutionize the industry while minimizing the environmental impact. Chemguard's FSFF agents meet UL162 Class B fire performance specifications for an AFFF product. The new 3x3 polar product will

be a non-film-forming product that meets all the requirement of a present AR-AFFF, and a product equivalent to fluoroprotein products will not contain protein but will meet the UL162 criteria for fluoroprotein. Of course, all new agents will be UL Listed. The development of these three new products is a significant contribution to our environment while increasing fire safety due to better performance, lower application rates, shorter



extinguishing time and improved burn back resistance.

CLA-VAL CO.

Booth 824

Cla-Val has a complete line of UL-listed and FM-approved fire pump relief, pressure-reducing, and deluge valves. These valves are available for freshwater and seawater service applications, and Cla-Val pours more than 40 alloys in our own foundry. When protecting life and property, depend on Cla-Val.

CUTLER HAMMER

Booth 1623

Designed to reduce the overall height of package installations, this 40 inch high by 12 inch deep controller allows installations in pump rooms that have restricted access and ceiling height. Available models include FDC20 Limited Service, FDC30 Across the Line and FDC60 Auto transformer models. All FDC20 Limited Service Controllers are available with or without LMR microprocessor control while FDC30 and FDC60 controllers are equipped with LMR microprocessor control as standard. All models meet UL, CSA, ULC, FM and NFPA 20 standards. Maximum horsepower rating is up to 100Hp. All models can be supplied with Automatic Transfer Switches.

DETECTOR ELECTRONICS

Booth No. 1419B

Det-Tronics flame & gas system goes into Texaco Pembroke refinery

Detector Electronics has been selected by Foster Wheeler Energy to supply the flame and gas system to protect a new process area for the production of ultra low sulphur gasoline at the Texaco Pembroke refinery.

The application includes Det-Tronics flame detectors, point IR gas detectors and H2S gas detectors, plus an Eagle Quantum addressable F&G control panel with two sets of local controllers. Detector Electronics is also supplying a complete one-stop-shop system solution by bringing in DEC products and Beacons sounders.

The switch from the previous supplier to Det-Tronics was based on the ability to expand the system and a reported savings of up to 70% in cable and installation costs as well as time savings.

Another key factor was the ability for the Eagle Quantum controller to interface with a distributed control system via RS485 Modbus serial communications link. Detector Electronics will be exhibiting at the NFPA World Safety Conference & Exhibition from their booth No. 1419B.

DUPONT COMPANY

Booth 1715

DuPont clean agent fire extinguishants are the agents of choice for replacing halon. DuPont FE-36™ replaces Halon 1211 as a streaming agent in portable extinguishers, and it can be used in local and total flooding applications, as well. DuPont FE-13™ is a clean, environmentally acceptable replacement for Halon 1301 which can be used in areas that are normally occupied. DuPont FE-25™ is a total flooding agent that can replace Halon 1301 in aircraft engine nacelles and other critical, unoccupied hazards. DuPont FE-227™ is a total flooding agent with zero ozone-depletion potential suitable for use in normally occupied enclosures, such as those found in the data processing and telecommunications industries.

EDWARDS MANUFACTURING INC.

Booth 645

EMI, the first with UL-listed and FM-approved positive displacement pumps for foam and water mist, is introducing another first: radiator-cooled, UL-listed and FM-approved engines for applications of 100 hp or below. Now, fire protection engineers have a water-saving diesel engine option to the traditional heat exchanger.

EST

Booth 1601

Edwards Systems Technology (EST) is the world leader in innovative life safety solutions for commercial and industrial applications.

Whether you're looking for stand-alone fire alarms panels, multi-sensor detection, signalling solutions, or integrated fire, access control and security systems. We have a life safety solution for you. Visit booth #1601 to see the latest in fire alarm technology.

Contact EST International to find the distributor or office nearest to you.

FAIRBANKS/MORSE PUMPS

Booth 731

Fairbanks Morse Pump manufactures a complete line of horizontal split case pumps with rated capacities of 250 to 5,000 gpm (946 to 18,927 lpm), vertical in-line pumps with rated capacities of 500 through 4,500 gpm (1,893 to 17,034 lpm). Units are UL-listed and FM-approved and are driven by either electric motors or diesel engines

FIRE FIGHTING ENTERPRISES LTD

Booth 0509

FFE SHOWS BEAM DETECTORS FOR WIDE-AREA PROTECTION

Optical beam smoke detectors from Fire Fighting Enterprises will be on show at the NFPA Exposition. Used in large interior spaces such as gymnasiums, museums, atria, prisons, shopping malls and places of worship, FireRay beam detectors provide a cost-effective alternative to "point" smoke detectors due to the wide area covered by each device.

Two lines will be on show – FireRay 2000, which features a wall-mounted controller providing basic control functions from a convenient ground-level position; and FireRay Reflective, which is an innovative product combining both beam transmitter and receiver in one unit, thus reducing installation costs.

Exhibiting alongside Fire Fighting Enterprises will be sister companies Apollo Fire Detectors Ltd and Air Products and Controls Inc. All three are members of the Fire and Security division of parent company Halma p.l.c.

FIRETROL, INC.

Booth 713

See the Firetrol D3ATA System Mark II, which monitors, displays, and records fire pump system status. This next-generation product offers many enhancements and user benefits. Also on display is Firetrol's FTA1100-D diesel engine fire pump controller with digital display and printer/recorder. Firetrol is a major manufacturer of UL-listed; FM-approved diesel and electrical fire pump controllers. The company also provides controllers for industrial and commercial motor control applications.

FOGTEC

Booth 1337

FOGTEC Fire Protection, one of the leaders in Water Mist Technology has relocated its US offices to Morgantown WV. This new location gives FOGTEC North America the ability to provide unique support to its customers, especially when it comes to high-pressure hydraulic systems, which are the basis of all high-pressure water mist systems. The close co-operation with the company Hydrosource gives FOGTEC access to long experienced hydraulic engineers, thus FOGTEC now is able to offer service by fully trained service personnel 7 days a week. Modules like pump units, valve cabinets, control systems etc. are manufactured and customised locally to meet customer requirements at the spot. A further benefit for FOGTEC's customers is the large warehouse facilities now being available.

FOGTEC North America's President Ruediger Kopp commented: "It just was a logical step for us. The interest in water mist is constantly growing and we wanted to have a stronger basis in the US. The new set up is the ideal back up for our activities in this market."

GREAT LAKES CHEMICAL CORPORATION

Booth 1331

Great Lakes Chemical Corporation presents FM-200®, the most widely accepted clean agent fire suppression technology available today and the leading choice of top fire suppression equipment

manufacturers worldwide. Learn how FM-200® systems can protect your critical equipment, employees, and business against fire-related losses.

KNOX COMPANY

Booth 1027

Knox Company manufactures high-security key boxes, vaults, cabinets, key switches, and padlocks. Fire departments have depended on Knox-Boxes for safe and secure emergency access since 1975. Other products include Knox FDC Caps, which protect standpipes from vandalism, and the Knox-Scan Infrared Heat Sensor, which detect hidden hot spots.

MASTER CONTROL SYSTEMS INC.

Booth 502

Master Control Systems, Inc. is the complete fire pump controller company, offering UL-listed and FM-approved fire pump controllers that meet NFPA 20 requirements. We offer electric controllers from 5 to 400 hp at 200 to 600 volts and from 20 to 1,900 hp at 2,300 to 7,200 volts. We also offer diesel fire pump controllers and accessories. Five-year warranties are standard on our EC-series controllers and paperless pressure and alarm recorders.

NELSON FIRESTOP PRODUCTS

Booth 1452

Nelson Firestop Products offers the industry's largest and most diverse firestop product line. Since 1963, Nelson Firestop Products have offered protection against fire, smoke, water, and explosions in industrial facilities, commercial buildings, military and commercial marine vessels, oil rigs, production platforms, and power generation facilities.

NFPA

Booth 1449

NFPA has been a worldwide leader in protecting the public through the development of quality codes and standards since 1896. An international non-profit organization with approximately 73,000 members and 80 member organizations from nearly 100 countries, NFPA's consensus-based development process has produced more than 300 codes and standards used by communities around the globe.

NO CLIMB PRODUCTS LIMITED

Booth 1343

No Climb Products, a genuine world leader in professional smoke and heat detector test and service equipment, is displaying the UL-listed Trutest, the universal and portable smoke detector sensitivity tester that measures actual sensitivity in just one test. It integrates with the SOLO range of universal tools, including telescopic access poles, functional smoke testers, cordless heat testers, and detector removal tools. No Climb products are available in North America through SDI and worldwide.

NOTIFIER

Booth 1219

Visit Booth 1219 to see the latest member of Notifier's new Onyx™ Series, the NFS-3030, our brand-new, one-loop, expandable-to-10, networkable, addressable fire alarm control panel. This multi-faceted panel supports up to 3,180 addressable devices; includes a large, 640-character display; and is completely field-programmable from display keypad or off-line PC. We continue to deliver on our commitment to meet your anticipated life safety needs.

OCV CONTROL VALVES

Booth 401

OCV, your best automatic control valve source, for over 50 years, manufactures valves that have become known for their dependable performance, long life, and simple maintenance. Professional engineering and sizing provided by OCV means you can expect quality products and support from specification to start-up. Globe and angle control valves are available in a wide range of materials in sizes ranging from 11/4 to 24 inches (3 to 61 centimetres) for all your fire protection application requirements.

PATTERSON PUMP COMPANY

Booth 615

Patterson Pump Company is the world's number one supplier of stationary fire pumps. Our products include vertical-in-line, vertical turbine, end suction, horizontal split case, and pre-packaged systems. We have offices in Singapore and Athens, Greece, and our manufacturing facility in Ireland serves Patterson worldwide.

POTTER ELECTRIC SIGNAL COMPANY

Booth 707

Potter Electric Signal Company is the premier manufacturer of sprinkler monitoring devices. Products include a complete line of water flow, pressure, and supervisory switches, including explosion-proof devices. Now available, Hydra Tank! Hydra Tank is a compact, self-contained water source for residential and light commercial applications that needs no electricity to operate. Also offered are releasing control panels, including the PFC-4410, a multi-hazard control panel with features usually found on larger systems, Potter is an ISO-certified company.

PROTECTOWIRE FIRE SYSTEMS

Booth 1836

Since 1938, The Protectowire Company has been a world leader in the design and manufacture of Linear Heat Detectors and Special Hazard Fire Detection Systems. Our product solutions include complete alarm systems for fire detection and protection of a vast array of industrial and commercial applications. As simple to install as running a wire, Protectowire Linear Heat Detectors reduce installation costs, can be installed in direct contact with potential sources of ignition, and can be used in environments that would destroy other types of detectors. Protectowire Linear Heat Detectors can identify the source of an over-heat or fire and when configured with a Protectowire Fire System Control Panel, display its location. The detector is available in single and dual temperature models and is compatible with other types of initiating devices to form a completely integrated fire detection system. For more information visit us at the NFPA World Safety Conference and Exposition, Booth 1836.

RECTORSEAL INC

Booth 1030

Rectorseal, founded in 1937, has been a leading manufacturer of quality specialty chemical products used in many disciplines of the construction industry. Rectorseal has also been recognized as a leader and innovator of new products used worldwide in the arena of passive fire protection. Seven years ago, Rectorseal completed the construction of a state of the art Fire Test Laboratory in Houston Texas. This facility is one of a handful of Fire Test Laboratories in the US recognized as part of the Underwriters Laboratories Witness Test Program. Under both the Metacaulk and the Bio Fireshield trade names, Rectorseal manufactures sealants, wrap strips, collars, putties, pads, inserts, pillows, composite sheets, etc. for the firestop industry. Rectorseal is also recognized in many countries for its highly intumescent strip material, BlazeSeal, used by door and window OEM's enabling their fire-rated products to pass the required 'positive pressure' fire test requirements. Come visit us at the NFPA World Safety Conference at booth 1030.

RELIABLE AUTOMATIC SPRINKLER COMPANY

Booth 324

Reliable is proud to announce our FM Approved K-22 Magnum ESFR, offering K-25 protection at K-22 flows and pressures. Just what you've been waiting for, a K-22 Magnum that provides you ultimate power for: Eliminating In-Rack Sprinklers, Design Flexibility, Tremendous Cost Reductions due to Lower Water Flow Demands, Huge Potential Savings By Using, Smaller Piping For Interior And Underground, Smaller Fire Pumps, Smaller Storage Tanks

Please call + 44 (0) 1.372.728899 or visit www.reliablesprinkler.com to take a look at the K-22 Marketing Bulletin to verify why the K-22 Magnum leaves the competition behind!

SECURIPLEX INC.

Booth 809

Detection or suppression, Securiplex has a solution for you. Our PRO-2000's unique, all-in-one fire and gas detection system eliminates the need for two separate control systems. Our Fire-Scope® 2000 fine water spray system is now FM-approved for local application, thus eliminating the need for an enclosure when protecting high-risk equipment.

TORNATECH INC

Booth 413

Tornatech manufactures fire pump controllers built to NFPA 20 and UL 218 standards. Among our products are electric fire pump controllers, electric fire pump controllers c/w automatic transfer switch, diesel engine fire pump controllers, and miscellaneous pump controllers such as jockey pump controllers, alarm panels, and booster pump controllers.

TYCO FIRE PRODUCTS

Booth 1119

Tyco Fire Products introduces SprinkCAD® Fire Protection Software for the Design Professional. SprinkCAD® is a Complete Fire Sprinkler System Design. SprinkCALC® is an Advanced Hydraulic Calculations. SprinkCODE® is an Interactive NFPA 13® Code Selector. SprinkSLIC® is a complete Fire Sprinkler Stock Listing. For more information, visit our web site at www.sprinkcad.com or call 800/495-5541 for a free demonstration.

TYCO SUPPRESSION SYSTEMS

Booth 1501

To fulfil our customers' global fire protection and safety needs, the companies of Tyco Suppression Systems continuously strive to provide the world's finest products through shared innovation, strict quality standards, worldwide distribution, and strong financial backing. Tyco Suppression Systems is part of the Fire and Security Division of Tyco International Ltd.

VIKING CORPORATION

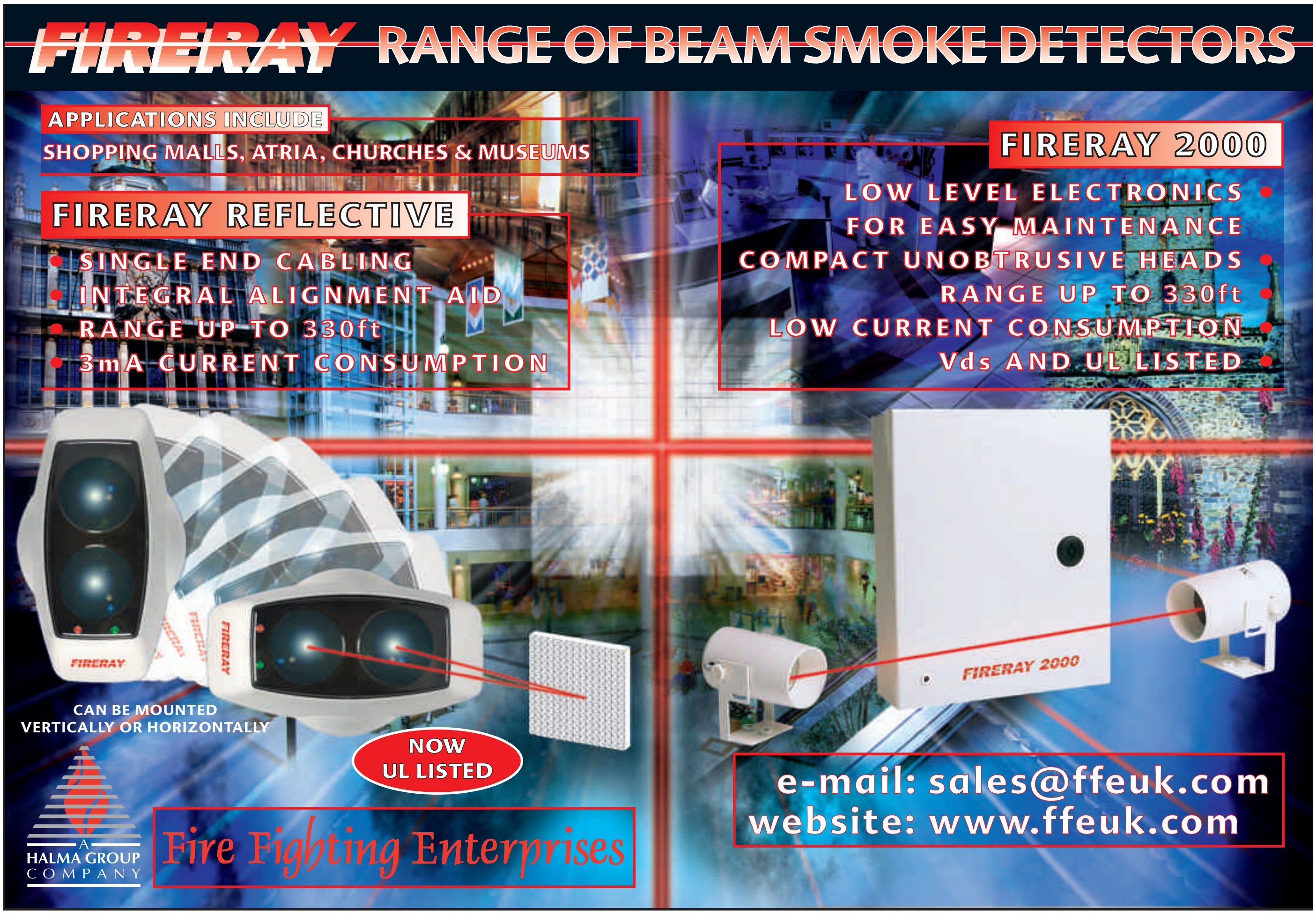
Booth 815

The Viking Corporation is a global leader in the manufacture and distribution of fire protection equipment. The Viking integrated distribution network is committed to providing a full line of quality and innovative products in over 70 countries. To see the latest products and services, visit our booth or visit our website at www.vikingcorp.com

WATTS/AMES COMPANY

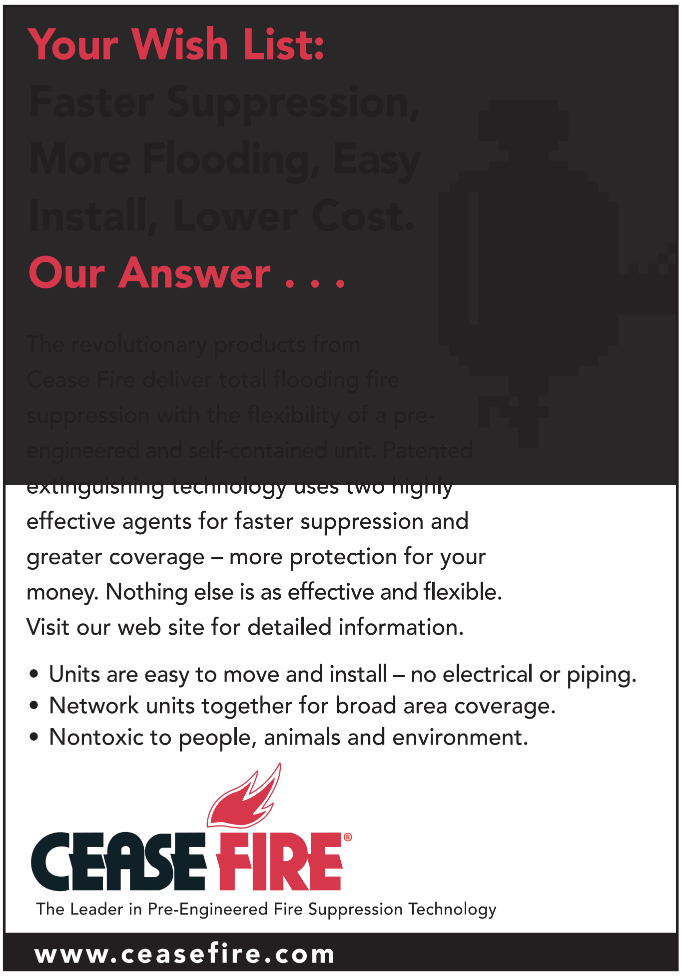
Booth 634

Ames Company produces stainless steel backflow preventers and fittings for pipeline and fire suppression systems. Ames combines advanced manufacturing techniques with high-quality workmanship to produce products, such as our portable hydrant backflow preventers and UL-listed and FM-approved fire service strainers, that meet the challenge of the most rigorous fire protection conditions.

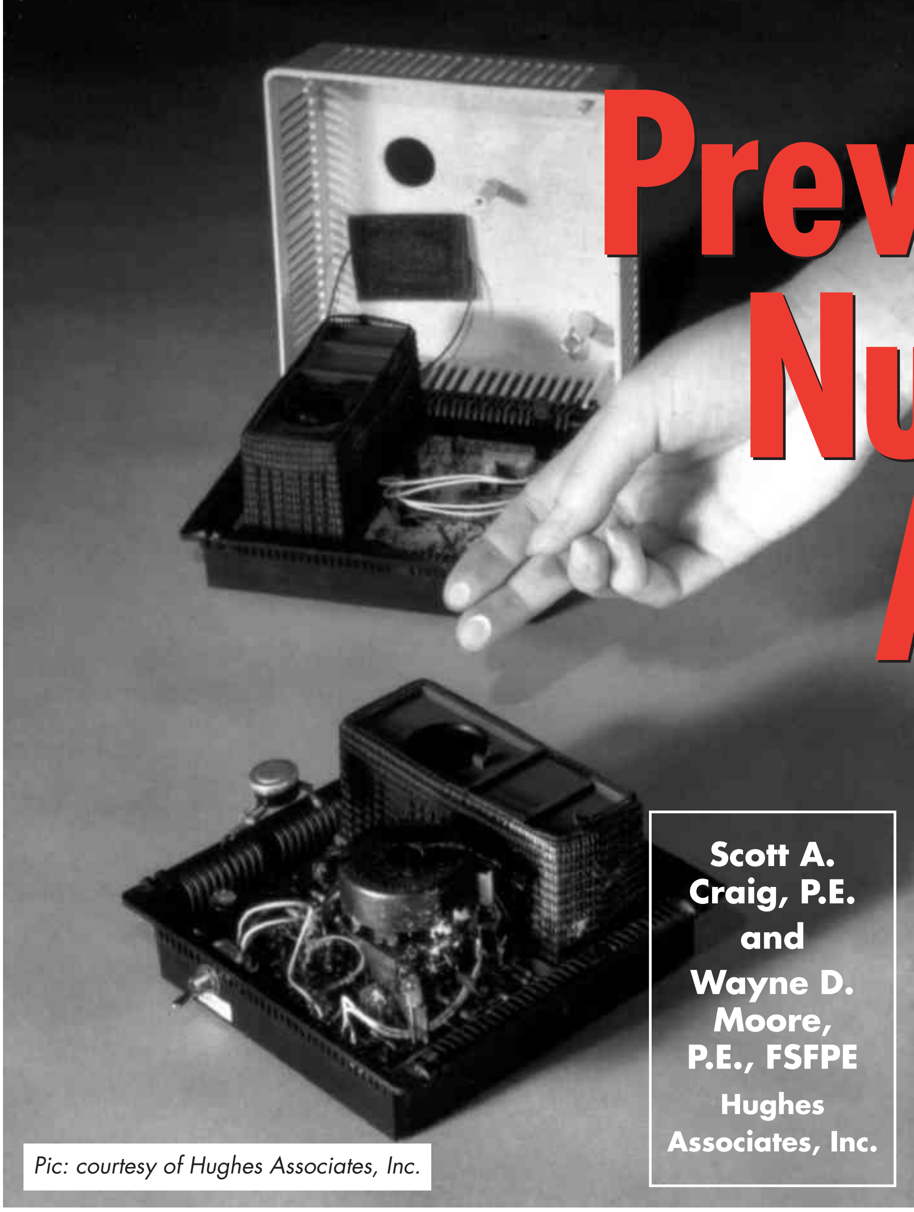


Enquiries: www.ffeuk.com

Enquiries: www.essexind.com



Enquiries: www.ceasefire.com



Pic: courtesy of Hughes Associates, Inc.

Preventing Nuisance Alarms

Scott A. Craig, P.E. and Wayne D. Moore, P.E., FSFPE
Hughes Associates, Inc.

A RARE NUISANCE ALARM from a fire alarm system does not normally pose a major problem for most facilities. Sometimes an unplanned evacuation can even impart important lessons, such as following correct evacuation procedures, or discovering a problem with evacuation routes. On the other hand, frequent and perpetual nuisance alarms can have serious and long lasting results. In one instance, during an alarm in a college facility a professor did not allow his students to leave the building. When questioned about his actions, he responded that he did not intend to interrupt his class for "another false alarm." Unfortunately, in this case the alarm had sounded for a real fire. Luckily, no one received serious injuries as a result of the failure to promptly evacuate.

Persistent nuisance alarms result in a fire alarm system losing credibility with occupants and emergency response personnel. Additionally, financial losses can prove substantial when nuisance alarms occur. Therefore, it is in the best interest of every owner, emergency responder, and fire safety professional to minimize nuisance alarms to the extent practical.

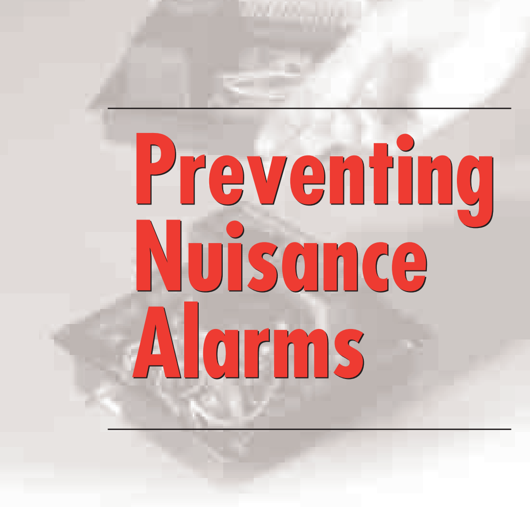
The National Fire Protection Association (NFPA) *National Fire Alarm Code* (NFPA 72) defines nuisance alarms as "Any alarm caused by mechanical failure, malfunction, improper installation, or lack of proper maintenance, or any alarm activated by a cause that cannot be determined." This definition often extends to include alarms caused by fire signatures that do not represent uncontrolled fire conditions. Examples would include a broken steam pipe activating a heat detector, or welding operations activating a smoke detector. In these cases the initiating devices operated as designed even though an uncontrolled fire was not present.

Frequent nuisance alarms will eventually reduce the credibility of a fire alarm system to the point where occupants will delay evacuation as in the example presented earlier. Some fire departments have instituted no response or a modified response to buildings with a history of nuisance alarms. This loss of credibility obviously presents the most dangerous consequence of nuisance alarms.

Financial impact is also a concern. Whether response to a nuisance alarm comes from an on-site fire brigade or a municipal fire department, expenses, sometimes in the form of "false alarm fines," result from this response. Additionally, if the nuisance alarm causes the evacuation of the facility, substantial loss can occur from interrupted business operations. Even a nuisance alarm that is quickly identified can result in a 15 to 30 minute delay before resuming facility operations.

The negative impact of nuisance alarms extends beyond building

Computer Centre.



Preventing Nuisance Alarms

evacuation. For instance, improper activation of an initiating device associated with a suppression system can cause agent release resulting in the possible increased danger to the occupants, expense of agent replacement, unprotected time, and down time for the facility. At one small power plant, halon discharge and turbine shutdown would occur on activation of a single flame detector within the turbine housing. A better design using "cross-zoned" detectors replaced the existing design after the first time a flame detector malfunction caused halon discharge and 8 hours of downtime.

How can we prevent, or at least minimize nuisance alarms? These key concepts contain the answers: system design, system installation, system maintenance, and controlling the environment.

SYSTEM DESIGN

NFPA 72 section 2-3.6.1.2 states, "The location of smoke detectors shall be based on an evaluation of potential ambient sources of smoke, moisture, duct, or fumes, and electrical and mechanical influences to minimize nuisance alarms." The fire alarm system designer has the responsibility to verify that the location of all proposed detection devices will minimize the potential for nuisance alarms. Obviously, different facilities present varying degrees of difficulty in conducting this analysis. For instance, a designer would typically avoid placing smoke detectors too close to a kitchen, or to a break area where smoking may be allowed. In contrast, a designer may have a more difficult time in avoiding an industrial process that gives off products of combustion if that process also requires some form of fire protection.

During the fire alarm system design, the designer must address all locations that present a potential for nuisance alarms. Each situation may have one or more possible solutions to resolve the problem, including alternative detection devices that meet or exceed the design criteria, special detectors designed to operate in the specific environment, or maintenance procedures that require inspection and cleaning of specific devices on a more frequent basis. However, a designer should use procedural solutions in excess of recognized standards only as a last resort, and only for facilities that can ensure compliance to the procedure for the life of the building. Another possible solution involves controlling ambient conditions by reducing the amount of expected fumes, dust or other pollutants to minimize their nuisance alarm potential. Regardless of the solution the designer chooses to use, he or she must maintain the original fire safety design criteria for the fire alarm system.

The reliability and stability of the equipment selected will also impact the nuisance alarm issue. Fire alarm manufacturers have made substantial advances in the last decade to improve reliability and to minimize the potential for nuisance alarms. New types of detection can adjust sensitivity to compensate for changing ambient environmental conditions. These detectors also offer another benefit: the ability to indicate when they become dirty and need attention. Many fire alarm control systems can also generate a report that indicates the sensitivity levels of all detectors on the system, which allow maintenance personnel to replace or clean detectors when those detectors approach their alarm levels. New detectors specially designed for dusty or humid environments are also available for designers to use in those instances where the environment cannot be controlled. Also, newer intelligent fire alarm control panels allow greater diagnostic abilities to better analyze causes of nuisance alarms.

Installation: high ceilings.

Technician testing integrity of wiring connection to a manual fire alarm box.

SYSTEM INSTALLATION

Installation offers one of the most important factors in controlling nuisance alarms. Installing smoke detectors too early in the building completion process or not following the manufacturer's installation requirements will lead to "epidemics" of nuisance alarms. The NFPA Initiating Devices Technical Committee recognizes this early installation issue. NFPA 72-1999, Section 2-3.6.1.3 states, "Detectors shall not be installed until after the construction cleanup of all trades is complete and final." Compliance with this requirement will help ensure that construction dust does not contaminate smoke detectors, thus causing them to alarm in non-fire conditions. An Exception allows the authority having jurisdiction to request that the detectors provide detection during construction. In this case, the exception states, "Detectors that have been installed during construction and found to have a sensitivity outside the listed and marked sensitivity range shall be cleaned or replaced in accordance with Chapter 7 at completion of construction."

Miswiring or poor installation practices also contribute to nuisance alarms. Loose connections, incorrectly

Equipment mounted exposed to the weather and elements.

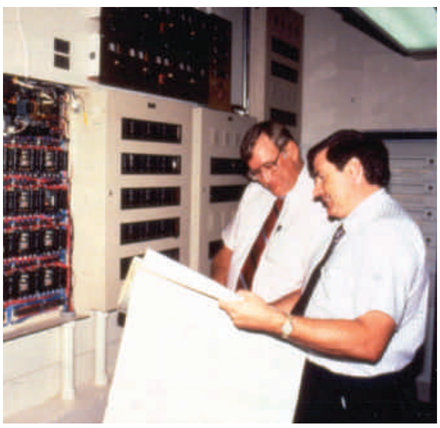
adjusted switches, or grounded connections provide some examples that can lead to numerous nuisance alarms. These often prove difficult to locate, resulting in a total loss of occupant credibility in the fire alarm system.

SYSTEM MAINTENANCE

The importance of routine maintenance including inspection, testing and cleaning of fire alarm systems cannot be over stressed. Without proper maintenance, a properly designed and installed system will become unreliable over time and will be more susceptible to nuisance alarms again reducing credibility of the system. To ensure proper operation, fire alarm systems need to be maintained and tested as required by nationally recognized and accepted standards.

Inspections will help ensure that each detector remains undamaged and in good working order. Each inspection should verify if a detector appears visibly dirty or installed in an environment that has changed since the original installation.

The Code also requires routine cleaning of devices. NFPA 72 section 7-4.2 states, "The frequency of cleaning shall depend on the type of equipment and the local ambient conditions." The standard recognizes that each situation will be different. However, the routine inspection, along with required sensitivity testing, will determine the cleaning frequency necessary to maintain a device in proper working order.



Inspectors reviewing drawings and installation.

After maintenance personnel test detectors, they sometimes use compressed air to clear the chamber of test aerosol. This will often also remove surface dust and other particulates. By following this procedure, technicians can sometimes postpone a thorough cleaning for several years. However, other facilities will require detectors to receive a thorough cleaning once a year to maintain the detector's listed sensitivity.

CONTROLLING THE ENVIRONMENT

The third step in minimizing nuisance alarms involves controlling the environment from unexpected or infrequent environmental issues. Examples would include exhaust fumes from a truck parked under an air intake activating a duct detector, smoke from a plumbing solder activating a smoke detector, or an unwarranted activation of a manual station. Each facility will have a different challenge in this area and have varying degrees of severity. A medical clinic office building may not have any problem with these types of nuisance alarms, while a facility that undergoes continual modification to support changing new tenants and equipment may experience a number of construction related alarms unless someone provides controls to minimize the potential.

The possibilities for problems and possible corrective action seem limitless. Eliminating all possible causes of nuisance alarms will prove nearly impossible. However, a facility must recognize potential problems and address known causes of nuisance alarms if they truly wish to minimize such alarms.

CONCLUSION

A fire alarm system design must address the nuisance alarm issue. Compliance with nationally recognized standards, with regard to proper system design, installation, and required maintenance, provides a critical first step in reducing the potential for nuisance alarms. Controlling the installation process to ensure compliance with the system design will prove equally important. When a building experiences too many nuisance alarms, a proper review of operations and the design and installation process is in order. Some times a simple educational effort with the building operations staff will alleviate the cause of the nuisance alarms.

In rare cases, it may be determined that a device originally included in a design is not necessary for the fire safety of the facility. However, oftentimes a device is a required component of the building's life safety system and an evaluation as to the proper corrective action is required. Designers recognize that new equipment and technology can be utilized to further reduce the potential and to ease maintenance of the system.

It is important to help owners and other individuals responsible for fire alarm systems to understand that it is not acceptable to simply remove or disable a device that is susceptible to nuisance alarms.

If the nuisance alarms cannot be controlled by maintenance, equipment or changing the environment, then further analysis is necessary to determine appropriate action.

Stable, reliable, nuisance alarm free fire alarm systems are the responsibility of designers, installers, owners and code officials. Each person plays a part in reducing nuisance alarms through design, installation and maintenance, and controlling the environment.

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FIRE-CRYER®

Voice Enhanced Sounders

The Fire-Cryer® voice enhanced sounder has been developed to counteract the ever-increasing problem of audible alarms being ignored. It eliminates any potential confusion by combining the normal sounder signal with a clear and unambiguous voice message. The Fire-Cryer® can be both heard and understood.

The Fire-Cryer® requires no special wiring and can be retrofitted to existing installations meaning that in-situ wiring can be easily utilised. Fire-Cryer® sounders are fully synchronised and have an exceptionally low current consumption allowing simple replacement of existing sounders and bells.

Up to **FOUR** different messages can be selected from a library of over 60 – with foreign language and bespoke messages also available. The Fire-Cryer's® clarity and high sound output using the existing 2-wire installation offers unmatched flexibility and ease of use. The need to cater for the broad range of fire protection requirements has led to an extensive English and foreign language message library encompassing a huge diversity of evacuation, alert, test and all clear messages.

The Multi-Message Fire Cryer® range offers an effective one-to-one replacement of traditional bells or electronic sounders. Working on just two wires, up to 4 messages can be controlled from the fire alarm control panel or the Voice Message Controller Unit. The family consists of:

Fire Cryer® – The standard unit provides an attention-seeking alarm signal at 100dBA with the voice content approximately 3dBA lower. Average current consumption is 20mA.

Mini-Fire Cryer® – Producing 90dBA in an all-round sound pattern the Mini offers a mounting platform for most detectors or may be used as a standalone bedroom/local voice sounder.

Midi-Fire Cryer® – A maximum sound level of 110dbA is produced and the cast aluminium housing makes it eminently suitable for industrial applications.

Maxi-Fire Cryer® – The Maxi offers 118dBA at just 180mA 24Vdc for applications in vast open indoor or outdoor areas or where high background noise levels exist. It is housed in a marine specification housing ensuring IP65.

The Fire-Cryer® and/or any combination of the members of the Fire-Cryer family may be connected to a common circuit thus offering unique flexibility for system designers.

Message Selection

With the ability to broadcast four messages on two wires the Fire-Cryer® is fully compatible with existing systems wiring. The Voice Message Controller (VMC) eases retrofitting of the Fire-Cryer® by providing the installer with a fully wired switching interface ready to be installed alongside the fire alarm panel. The VMC is also available as a PCB only.

In the event of an alarm the default (usually the evacuation message) signal is broadcast. This message will consist of firstly an attention-seeking tone followed by a short, clear unambiguous message such as "Fire! Fire! Please leave the building". This will be repeated continuously until, as with normal systems, the fire panel is reset. This, however, is where the familiarity with normal systems ends.

With the VMC you have the benefit of broadcasting an additional 3 messages without the need for additional sounder circuit wiring. The VMC, on operation of one of the message key switches will transmit, using its patented protocol, a series of pulses along the sounder circuits. These pulses ensure 100% synchronisation and trigger the individual Fire Cryers® to broadcast the selected message. This message however will be immediately overridden by the default evacuation message in the event of an alarm being activated.

Applications

The obvious choice for any installation where the fire alarm requires verification by voice, the Fire-Cryer® lends itself to an extremely wide range of applications. Typical examples include:

Shopping Centres – Most shopping centres have large voice evacuation systems incorporated within the PA system in public areas – but what about the individual units? The Fire-Cryer® can ease confusion for the public by instructing them in a concise and intelligible manner what emergency action should be taken.

Places of Public Entertainment – Nightclubs, concert halls and other entertainment venues can often be noisy and dark. Fire-Cryers® can be utilised in conjunction with a pre-alarm such as strobes or a coded message to staff and trained personnel followed by a clear and non-panic inducing evacuation instruction.

Areas of Mass Transit – The mass evacuation of an airport or railway station due to a false alarm is every facility manager's nightmare. The use of coded messages and time-out function in the Fire-Cryer® enables a period of verification prior to general evacuation.

The Fire-Cryer® range is manufactured by

VIMPEX LTD

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Vanguard Way, Shoeburyness,
Essex SS3 9QJ, England
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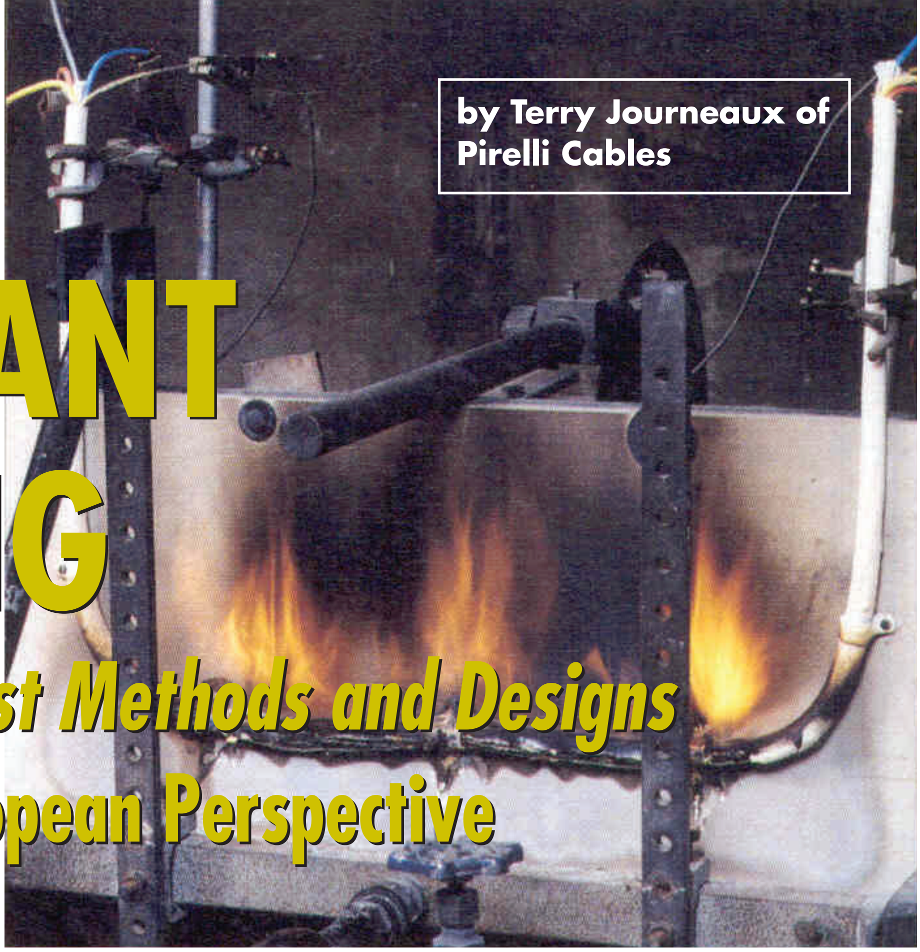
FIRE RESISTANT CABLING

Applications, Test Methods and Designs – a UK and European Perspective

by Terry Journeaux of Pirelli Cables



Typical mica taped insulation armoured cable design.
(FP400 illustration courtesy of Pirelli Cables)

Although fire resistant cables, which may be defined as "A cable with the ability to continue to operate in the designated manner whilst subjected to a specified fire test scenario for a specified period of time", are widely used to support essential systems in many countries, the degree of standardisation, both in terms of product and test requirements, is still limited.

Also with the growth of a fire safety engineering approach to building design, Regulators in some countries are beginning to reconsider the performance requirements for the cables necessary to power life safety, fire fighting and property protection systems.

APPLICATIONS

European Fire Regulators have recognised two distinct areas of application for fire resistant cables:

- unprotected small cables for use in emergency circuits for alarm, lighting and communication purposes
- protected or unprotected power cables for use in emergency circuits in fire fighting systems

Cable manufacturers have also recognised these distinct application areas and developed a range of products to specifically meet the performance and installation requirements of each.

Circuits relating to alarm and evacuation might include fire detection, fire alarm sounders, central battery emergency lighting, safety signalling and voice alarm systems. This type of application is generally characterised by the need for many km of small conductor size cable to be installed and many hundreds of terminations to be made. Ease of installation, together with reliable technical performance is thus a prime need.

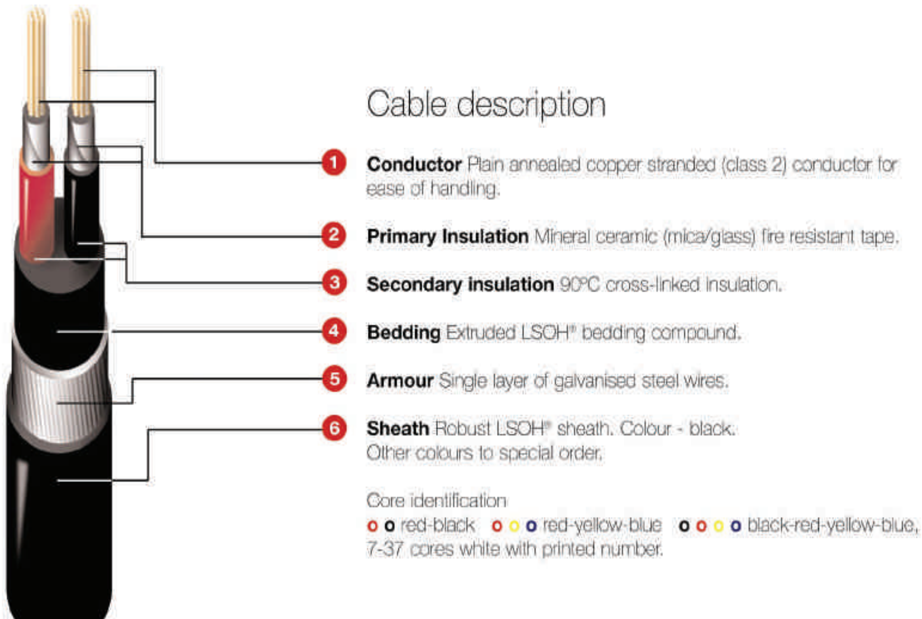
Circuits relating to fire fighting systems might include smoke extraction, smoke venting fans, fire shutter control, water supply pumps, fire lifts and pressurisation fans. These are generally specific circuits using larger power conductor sizes and are becoming increasingly important as such facilities are used as part of a fire safety engineering approach to building design. In some countries, armoured cables are preferred to give a combination of mechanical and fire protection to ensure the integrity of the circuit.

TECHNICAL REQUIREMENTS

The ability to meet the technical performance requirement is usually based upon overall requirements given in Regulations or Codes of Practice translated into specific test requirements by cable test standards and then possibly into prescriptive constructions by a cable product standard. For example, in the UK for fire alarm systems, the relevant Code of Practice is BS5839 "Fire detection and alarm systems for buildings" which calls up performance demonstrated by the test requirements of BS6387 "Performance requirements for cables required to maintain circuit integrity under fire conditions". Product standards such as BS7629 "300/500V fire resistant electric cables having low emission of smoke and corrosive gases when affected by fire" call up the BS6387 tests. MICC cables to BS6207 "Mineral insulated cables with a rated voltage not exceeding 750V", which are also listed in BS5839, will also generally comply with the BS6387 tests, although only the less demanding IEC60331 test requirement is required by BS6207.

TEST METHOD DEVELOPMENT

The need for European harmonisation has been identified by the EC as currently there are many National



Typical mica taped insulation design.

(FP100 illustration courtesy of Pirelli Cables)

Standards often supporting National regulations and the resulting products are often country specific. Tests to demonstrate the ability of a cable to maintain circuit integrity under test conditions fall under the generic types – large furnace, small furnace, open flame, open flame with shock and open flame with shock and water attack. This variety will continue to make the harmonisation process difficult. However, new standards have been promoted under the Construction Products Directive. Work on a test method for unprotected small cables or systems up to 20mm diameter and with conductor sizes of $2.5mm^2$ or less has been completed with the issue of EN50200:2000, which enables a time, based classification between 15 and 90 minutes to be obtained. European Regulators agreed a constant temperature attack, open flame protocol based upon a temperature of 842C, typically that found in room fires. The EN50200 test is conducted with flame and indirect impact applied to the cable, which is installed on a test wall with a double bend, to simulate the most critical installation condition. This approach of performance based requirements, must surely be supported as a means for proper competition in the marketplace.

However, the European solution has so far had little impact on existing National requirements. In the UK, EN50200 has been criticised for not including a water spray element in the test, although this is being progressed as new work for an optional addition to the test protocol.

Whilst good progress has been made on a harmonised European test for smaller cables, definition of test methods for larger cables and cabling systems provided with a fire protective system has proven more problematical. Cenelec has set up a special working group (CLC BTWG 101-4 "M/117 – Resistance to fire") to monitor the work and offer guidance on common features relating to the work program. BTWG 101-4 objectives are to seek, where appropriate, to achieve an acceptable overall commonality of approach between product technical committees with responsibility for developing test standards for their products, especially in respect of:

- fire conditions
- representative installations
- functional requirements

Typical high performance extruded insulation design.

(FP200 illustration courtesy of Pirelli Cables)

The test methods should be suitable for use with the decision on classification and EN 13501-3 "Fire classification of construction products and building elements – Part 3: Classification using data from fire resistance tests on components of normal building service installations". Progress has been difficult, as the only means to meet the classification requirement appears to be through the use of a large-scale furnace test, which, historically, is not widely used or accepted for cable testing. The known lack of repeatability and reproducibility of such tests suggests that improved furnace testing procedures will need to be developed. A final report from the BTWG is expected during 2002.

Within IEC, recent work on cable test methods for fire resistance has largely concentrated on improvements to methodology and introduction of verification procedures. The long standing IEC 331:1970 was replaced in 1999 by IEC60331 Parts 11, 21, 23 and 25. This revision introduced specific procedures for data and optical cables, together with a well-defined and controlled burner system similar to that used in EN50200. However, the IEC test lacks the use of a test wall to stabilise and intensify the flame source, lacks bending of the cable which tests under the most stressed condition, does not apply mechanical shock and is not limited to smaller cables. The test is thus of

limited severity in comparison with EN50200, particularly when testing larger cables. The draft Parts 12 and 31 are technically aligned with prEN50362 and will provide a much more onerous and realistic test with larger fire source, cable tested with a bend and subject to mechanical shock. It is to be hoped that the deficiencies of Parts 11 and its associated procedures will be addressed following the adoption of Parts 12 and 31.

STATUS OF IEC 60331 TESTS FOR ELECTRIC CABLES UNDER FIRE CONDITIONS – CIRCUIT INTEGRITY

Part 11: Apparatus – Fire alone at a flame temperature of at least 750°C Published 1999

Part 12: Apparatus – Fire with shock at a temperature of at least 830°C FDIS 2002-04-02

Part 21: Procedures and requirements – Cables of rated voltage up to and including 0,6/1,0kV Published 1999

Part 23: Procedures and requirements – Electric data cables Published 1999

Part 25: Procedures and requirements – Optical fibre cables Published 1999

Part 31: Procedures and requirements for fire with shock – Cables of rated voltage up to and including 0,6/1,0kV FDIS 2002

CABLE DESIGN

Detail cable design will depend upon the test requirement that the cable is required to meet. Performance against the various test requirements is usually achieved through a combination of cable constructional design and material selection. Historically, fire resistant cables have achieved their performance through typical types:

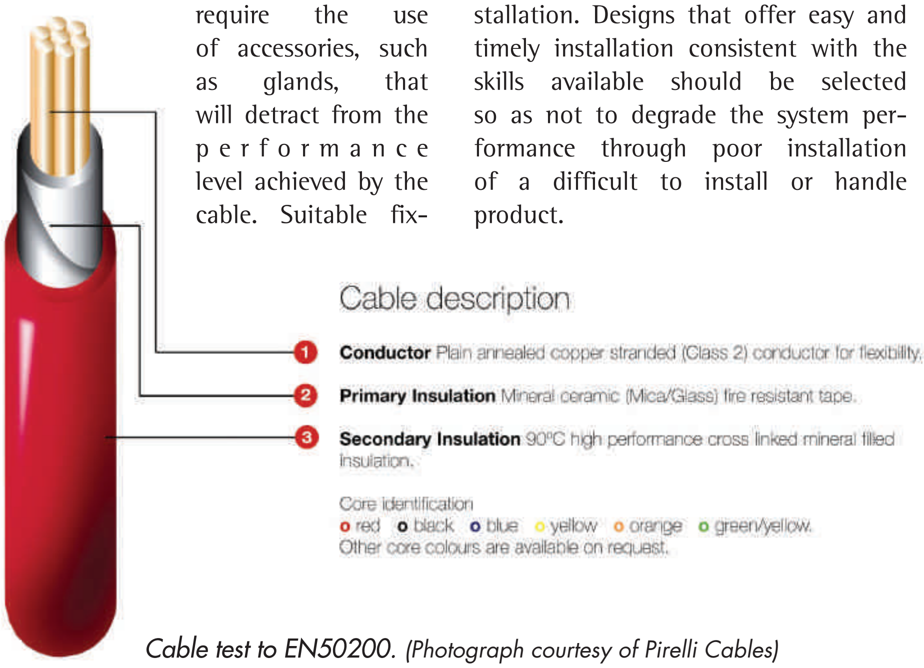
- Mineral insulated copper sheathed design (MICC) in which an inert powder (usually magnesium oxide) is enclosed in a continuous copper sheath.
- Silicone insulated in which a specially formulated filled silicone turns to a cohesive ash upon burning.
- Mica tape insulated in which the mica in a tape applied to the conductor fuses under heat to form an insulating layer.
- High performance extruded insulation such as Pirelli "Insudite" developed to perform in a similar manner to Silicone but exhibiting superior fire performance and mechanical robustness.

Whilst MICC designs can offer a high degree of fire resistance, their need for special installation techniques means that the easier to install extruded insulation designs are more widely used. The use of silicone insulation is generally restricted to the smaller cables for fire alarm and emergency lighting use, but is often characterised by mechanical properties that make it prone to damage. These deficiencies are overcome by the newer high performance extruded insulation types. Mica taped insulation is used for the larger power supply cables. Until recently, cable types subjected to a large-scale furnace test have used mica tape constructions, but advances in performance given by new silicone based high performance insulations has resulted in these now being used in some designs.

INSTALLATION

Installation features are also an important feature in the selection of fire

resistant cables. Consideration of the wide range of installation conditions possible suggests that a range of cables, each designed for specific installation conditions would be more appropriate than a single product type. Each cable type should be compatible with the other components of the system in which it is to be used and should not require the use of accessories, such as glands, that will detract from the performance level achieved by the cable. Suitable fittings should also be available to ensure "system" performance. Cables for such important circuits should also be selected with consideration of their resistance to damage, both during installation through the use of damage resistant insulation and appropriate handling features, and, to external forces after installation through the use of armour or method or installation. Designs that offer easy and timely installation consistent with the skills available should be selected so as not to degrade the system performance through poor installation of a difficult to install or handle product.



Cable test to EN50200. (Photograph courtesy of Pirelli Cables)

QUALITY AND RELIABILITY

The quality and long term reliability of the product selected may be assured through choice of a manufacturer of long standing and proven track record in the market. The manufacturer should preferably offer a range of products, enabling them to take a balanced view towards their product recommendation for any particular application. Technical performance should be supported by independent third party assessment and certification from a recognised approval body.

THE FUTURE

As Regulations, Codes of practice and test methods are reviewed and revised, it is clear that the market leading suppliers of fire resistant cables will need to remain committed to providing new, cost effective and easy to use products to meet these requirements. Material and product development has already lead to considerable improvements in performance of extruded insulation designs and it is to be expected that this will continue through further material improvements and innovative designs.

Pic: courtesy of Promat UK Ltd

Fire Rated Cladding of Structural Steel

by Ron Smith

Technical Consultant to the Association of Specialist Fire Protection

It is essential, prior to the design of any contract requiring the fire protection of structural steel, to establish a comprehensive list of the necessary criteria which will enable the installer to provide a fire safe, economical solution for the protection of the building elements.

Such criteria should include the following:

- The fire resistance period required
- Is the element to be protected load-bearing
- The size and weight of the steel sections
- The orientation of the steel sections (beam or column)
- Is there likely to be significant movement in the structure
- Does the fire protection material need to be mechanically strong (resistant to impact damage)
- Will the fire protection material be hidden or on view
- The condition of the structural steel to which the material is to be applied
- The working environment of the building (high humidity/temperature/dust free)
- The height and accessibility of the elements to be protected

The selection of the best systems and boards required for a particular contract lies with the designer/specifier but, if one considers the vast range of boards/systems now available, how does he or she select those which will be suited to the specific project? It is essential that the specifier and the installer "get it right first time" because the cost of remedial work after completion of the contract may exceed the actual cost of the initial installation – not to mention consequential damages.

Fire resistant boards

For many years' asbestos fibre bound in cement was the main fire resistant board available throughout Europe, but technology has changed considerably. Asbestos has been replaced in present day fire resistant boards, which now use vermiculite, gypsum, mineral wool, etc and are proving to be equal to the old asbestos based boards. The extensive range now available provide high quality, non-combustible, fire resistant linings to walls, partitions and floors as well as the fire protection of structural steel beams and columns. This new generation of boards can also be used to manufacture fire rated ductwork.

Excluding blankets, fire resistant boards can be generally divided into three main generic groups as follows:

- **High Density.** These boards range in density from around 750 – 1100 kg/m^2 and include fibre reinforced calcium silicate boards, fibre reinforced gypsum boards and steel cased boards. They are able to provide up to 4 hours fire protection to structural steel
- **Medium Density.** Boards in this group range from around 200 – 750 kg/m^2 in density and include reinforced vermiculite gypsum

Pic: courtesy of Promat UK Ltd

Fire Rated Cladding of Structural Steel

boards, fibre reinforced and unreinforced calcium silicate boards, compressed mineral fibre boards and steel cased boards. These boards are also able to provide up to 4 hours protection to structural steel.

- **Low Density.** The lowest density range of boards, around 100 – 200 kg/m^2, which consist of resin bonded mineral fibre boards and panels and steel encased boards. These boards are also capable of providing up to 4 hours fire protection to structural steel.

The above mentioned board types each have their own installation systems, which can be significantly different from one manufacturer to another. It would be wrong, therefore, to assume that one type of generic board could be fitted in the same way as another. As stated earlier, when selecting a board for fire resistance purpose, consideration must be given to a variety of factors such as the working environment, likelihood of damage, whether or not the board will be on view or hidden, etc. The correct preparation of the substrate is also essential to ensure a that the boards will remain in position in fire situation.

Fire tests to BS 476 – 21

At present, in the UK, fire resistant boards used to protect structural steel elements of construction are tested in accordance with the requirements of BS 476 – 21. This part of the British Standard 476 series gives procedures for determining the fire resistance of loadbearing elements of building construction when subjected to the heating and pressure conditions specified in BS 476 – 20.

Four metre long steel beams, as loaded in practice, are tested in the furnace to the standard time temperature curve specified in part 20. Three metre high columns, also as loaded in practice, are tested in a special column furnace. The tests on loaded sections are carried out with the loads on the specimens calculated to give critical temperatures of 550°C for columns and 620°C for beams. Methods of assessing the performance of fire protection materials have also been developed in the UK, which enable the thickness of protection for a wide range of situations to be predicted. These assessments are primarily based on test information from UKAS (NAMAS) approved laboratories.

Following the appropriate test package, an assessment must be prepared by either the test laboratory or by a qualified engineer in order to determine the required board thicknesses for specific sized steel sections for various periods of fire resistance. The assessment report should fully detail the scope of the approval, basis of the assessment and justification for any deviations from the procedure of the assessment method. All test data used in the preparation of the assessment should be fully referenced by test number, test standard and type of test, i.e. beam or column, loaded or unloaded, full scale test or small scale test, etc.

Pic: courtesy of Promat UK Ltd

Pic: courtesy of Promat UK Ltd

The Association for Specialist Fire Protection, in conjunction with BRE, LPC and WFRC has developed an assessment procedure, which is used by the laboratories and detailed in the ASFP "Yellow Book". By default, it can be assumed that the assessment method defined has basic approval within the fire protection industry because the Yellow Book is referenced in the current Approved Document B.

Installation of fire protection cladding to structural steel

In the past boards were fixed around columns and beams by very labour intensive systems. One specific example, based upon the use of plasterboard for the protection of columns, worked on the principle that the boards were held in position by using 1.2mm diameter steel wire. The wire was either spirally wound around the boards at 100mm pitch or banded at 100mm centres around the boards. The protection of beams was even more labour intensive. Steel angles or channels, 0.7mm thick, were fixed to the underside of the concrete soffit with fixings at nominal 300mm centres. The 1.2mm wire was then laced through the angles or

Pic: courtesy of Promat UK Ltd

channels at 100mm centres and banded around the board. These "complete casings" were then plastered.

The other, main system used in the past, relied on 44mm x 44mm timber battens (dare I say ex 2" x 2") formed as cradles around the steel section(s). These battens/cradles spaced the boards away from the steel and this system is still in limited use today – although the batten sizes would be smaller.

The method used for the installation of the board(s) on site must be the same as that used in the fire test or on an assessment based upon the test(s). It is therefore worth mentioning that the ability of any board to perform its design function is dependent on the correct method of installation. The manufacturer who, in turn, must have supporting evidence from the fire test laboratory or authorised assessment authority, should approve any deviation to the tested method of fixing.

Methods of installation, as mentioned earlier, vary from one product to another and will also vary according to the density of the board, the size of the steel section and the required fire protection performance specified. Installation can involve the construction of a sub frame (cradling) based on the use of steel angles, steel channels, or a combination of angles and channels. Longitudinal angles are usually around 25mm x 25mm and angles fitted to concrete soffits are usually around 38mm x 19mm. The additional depth of angle (38mm) is required in order to provide sufficient room for the screws to be fitted. The boards are fixed to the sub frame with self-tapping screws or by means of special clips. Thicker boards can be fixed by screwing the boards together without the use of a sub frame.

Medium and lower density boards can be fixed by the use of noggins/soldiers, glue and screws or nails. Propriety clip systems are also available to fix these boards and special spiral "corkscrew" type screws (known as "pigtail" screws) can be used to fix the low-density boards together. When very low-density boards are to be used, capacity discharge pins can be fixed to the steel section. The boards are then "impaled" on the pins and secured to the pins by non-return washers.

When a single layer of board is to be used to provide the fire resistance specified, the joints would normally need to have a cover fillet inserted behind the board. This is because boards will shrink in a fire situation and hot gases and flames would be able to pass through the joint and cause the steel temperature to rise above its critical temperature. Where two or more thicknesses of board are used the joints should be staggered to ensure the continuity of the joints and to prevent the ingress of hot gases and flames.

Where glued noggins/soldiers are to be used it is essential to ensure that the web and flanges of the steel is clean and free from millscale or rust at the position where the noggin/soldier is to be fitted. Gloss paint should be removed from the area, but it is usually acceptable for primers to remain. The noggins/soldiers should be wedged and glued in position and it is usual to employ double noggins/soldiers at board joint positions.

The list above right is by no means exhaustive but will hopefully provide the reader with an idea of what needs to be checked on site.

A FEW ITEMS TO CHECK ON SITE

Does the size and gauge of the steel angles/channels conform to the specification issued by the manufacturer?

Are the screw sizes (No 8?) and lengths as specified by the manufacturer (screws should normally be of sufficient length to penetrate the angle/channel by around 10mm)?

Are the screws fitted at the correct centres (normally would be between 250mm – 300mm centres?

If screw plugs are used to secure angles/channels to concrete/ brickwork substrates, are the plugs non-combustible?

When fixing boards to boards, do the screws penetrate sufficiently far into the board edge?

Are the screws too close to the ends of the boards at joints (too close will cause the screws to pull through the end of the board in a fire situation)?

Has the steelwork been cleaned prior to fitting noggins/soldiers?

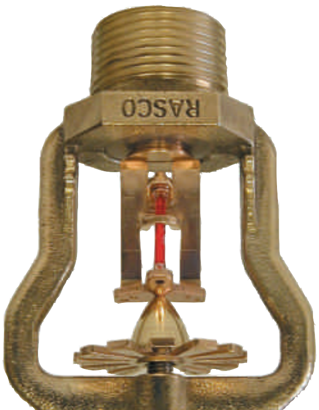
If specified, has adhesive been used to secure the noggins/ soldiers?

Has adhesive been used at joint positions?

Conclusions

I cannot stress strongly enough that incorrect installation of boards can cause the system to fail in a fire. It seems that it has now become standard practice on the smaller sites for a carpenter to fix fire resistant boards. Does he really understand how the boards should be fixed, the fixing centres required, the size and lengths of the screws, etc? From the problems I have seen on site, I would suggest that in 90% of the installations viewed, boards fitted by non specialist sub contractors would not achieve the specified fire resistance. The use of third party accredited installers is a must – we are talking about life safety, not giving a job to a carpenter to keep him occupied until second fixings are required. Lists of third party accredited installers are available from Chiltern Fire, the LPCB and WFRC (FIRAS).

THE K-22-MAGNUM
ESFR SPRINKLER



FM APPROVED!

MINIMUM WATER FLOWS FOR MAXIMUM IMPACT...

- THIS SPRINKLER HAS BEEN OPTIMIZED FOR 45 FEET HIGH BUILDINGS. THE MINIMUM SYSTEM DESIGN SAVINGS IN GPM REQUIRED IS 240 GPM — BELOW THE K-25!

Performance Characteristics for Factory Mutual Requirements:

SINGLE SPRINKLER PRESSURE & FLOW REQUIREMENTS

BLDG. HEIGHT (FT.)	K-14		K-25		K-22	
	PRESSURE	FLOW	PRESSURE	FLOW	PRESSURE	FLOW
30'	50 PSI	99 GPM	20 PSI	113 GPM	25 PSI	112 GPM
35'	75PSI	121 GPM	30 PSI	138 GPM	35 PSI	133 GPM
40'	75 PSI	121 GPM	40 PSI	159 GPM	45 PSI	150 GPM
45' W/ 35' STOR.	90 PSI*	133 GPM*	50 PSI	178 GPM	50 PSI	158 GPM
45' W/ 40' STOR.	90 PSI*	133 GPM*	50 PSI	178 GPM	50 PSI	158 GPM

* K.14 Must Include one row of in-rack sprinklers.

- LOWER FLOWS OFFERS OPPORTUNITIES TO REDUCE:
  - INTERIOR PIPING
  - UNDERGROUND PIPE
  - FIRE PUMPS SIZES
  - TANK SIZES
- MAXIMUM DEFLECTOR DISTANCE FROM CEILING (ROOF) = 18 INCHES.
- AVAILABLE IN 155°F AND 200°F

3/02

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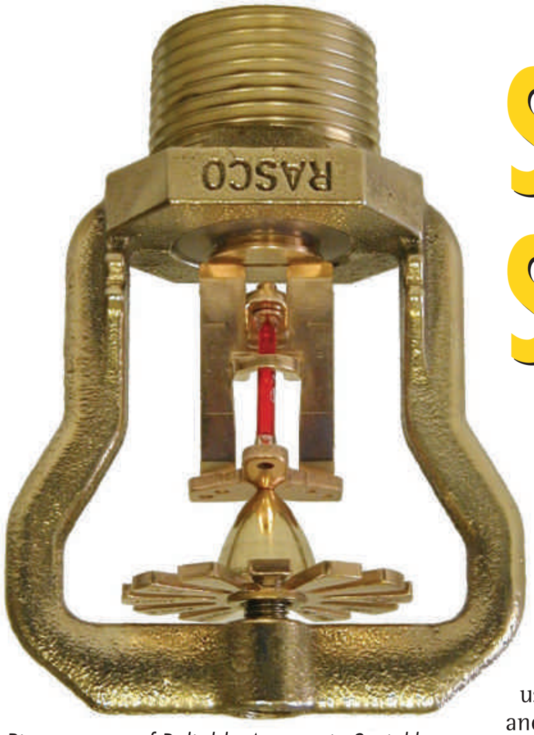


Storage Occupancy Sprinklers:

One Size Doesn't Fit All

by Salvatore J. Izzo, P.E.

Pic: courtesy of Reliable Automatic Sprinkler Company

WITHIN THE LAST DECADE, storage occupancies have prevailed as being one of the most challenging and diverse fire protection environments. No other occupancy involves such a wide range of hazards and variety of products stored under one roof. New materials and commodities, methods and arrangement of storage, building size and increased storage heights have all contributed to this fire protection challenge.

Storage classifications have expanded, and storage and retrieval methods associated with these occupancies have changed dramatically, demanding more efficient and cost effective fire protection solutions that could not be provided in the past by the traditional spray sprinkler. Utilizing sprinklers with K-factors of 80 (5.6) and 110 (8.0) often yielded high-pressure requirements where densities of 13.9 mm/min (0.34 gpm/ft^2) and higher were needed. The use of larger pipe, looped cross-mains, and fire pumps with higher-pressure ratings were needed to meet the hydraulic demands of the sprinkler system. No longer does one orifice size fit all storage applications.

The sprinkler industry and the testing laboratories recognized that these changes required something more than the traditional methods of protecting these occupancies. Based on full-scale fire testing by manufacturers and consortium groups, the fire dynamics associated with different fuels and their arrangement are being learned and applied to new sprinkler technology. Laboratory capabilities accommodating new design parameters for fire testing, as well as knowledge gained from past fire loss experience, have assisted to this end. The use of standard orifice 15mm (1/2″) and large orifice 20mm (17/32″) spray sprinklers will be limited in the future as sprinklers with K-factors of 160 (11.2) and greater have demonstrated through this testing that they can provide better fire protection while providing cost savings. More water from the initial opening sprinklers lends itself to better protection, while lower pressure requirements provide opportunities for cost reductions in pipe sizes, fire pumps, storage tanks, installation, material and labor costs.

APPLICABLE DESIGN GUIDELINES FOR STORAGE FIRE SPRINKLER SYSTEMS

Design criteria defining these storage commodities, arrangements and fire sprinkler requirements can be found throughout several National Fire Protection Association (NFPA) documents and HPR insurance regulations, such as FM Global Property Loss Prevention Data Sheets. Local jurisdictional requirements and preferences may also be in addition to these minimum standards.

Design density curves in the standards and guidelines make use of several variables to determine the proper ceiling sprinkler density requirements. Considerations are given for the type and arrangement of storage, storage height, sprinkler temperature rating, aisle separation distances, use of in-rack sprinklers, stable and unstable piles, and encapsulation. Consideration also should be given to the maximum possible storage height and potential increases in commodity hazards.

Beginning with the 1999 edition of NFPA 13, *Installation of Sprinkler Systems*, several of the existing NFPA storage standards were incorporated. However, the standards for the protection of flammable liquids and aerosol storage must still be referenced specifically.

Of particular interest in the NFPA 13, 1999 edition were the limitations imposed on the orifice size of spray sprinklers that can be used to protect storage occupancies:

1. Sprinklers having a K-factor of 80 (5.6) are limited to protecting storage where the design density is 8.2 mm/min (0.20 gpm/ft^2) or less.
2. Sprinklers having a K-factor of 110 (8.0) are limited to protecting storage where the design density is 13.9 mm/min (0.34 gpm/ft^2) or less.
3. For densities greater than 13.2 mm/min (0.34 gpm/ft^2), sprinklers must have a K-factor of at least 160 (11.2).

This recognized that at the higher densities, not all spray sprinklers are created equal with regards to effective fire control.

TYPES OF STORAGE SPRINKLERS

All storage sprinklers with the exception of ESFR sprinklers are control mode sprinklers; that is, they limit the size of the fire by decreasing the heat release rate of the fire, wetting the combustibles surrounding the area, and cooling the hot gases at the ceiling. Suppression-mode sprinklers operate in the early stage of a fire, sharply reducing the heat release rate of a fire and delivering a large amount of water at high momentum through the fire plume to the seat of the fire.

Spray Sprinklers

Spray sprinklers having K-factors of 80 (5.6) and 110 (8.0) traditionally have been used for storage protection as stand-alone ceiling systems, or as combination ceiling and in-rack systems. These sprinklers required high operating pressures to meet the higher density requirements for the commodities being protected, and imposed limitations in the flexibility in the type of building storage and storage configurations. Testing as well as loss experience demonstrated that increasing the density for these sprinklers did not guarantee an increase in sprinkler performance. With the recent developments of the larger orifice spray sprinklers specifically listed for storage applications, testing showed that their use greatly enhanced the performance of these increased densities. More effective

fire control was demonstrated over the fire by the initial operating sprinklers, resulting in fewer operating sprinklers and more water to be delivered to the initial sprinklers at lower pressure requirements. Therefore, one can ascertain that the use of K = 80 (5.6) and K = 110 (8.0) ceiling sprinklers will be limited in the future.

To efficiently use the larger orifice spray sprinklers, design densities must exceed certain values based on the minimum 7 psi pressure requirement stipulated by NFPA 13. To do otherwise would lead to over-design and a more costly system.

Special application listings for some of these larger orifice spray sprinklers will permit reduced designs, cutting in half the water demand for the system as well as provide the required densities at lower starting pressures. The manufacturer's literature will contain the specific design and listing criteria regarding these applications; this criterion will not be found in any of the published standards or regulations.

Pic: courtesy of Reliable Automatic Sprinkler Company

Sprinkler K-factor	"Best-Fit" Design Density Range *
80 (5.6)	Up to 8.2 mm/min (0.20 gpm/ft^2)
110 (8.0)	8.2 mm/min (0.20 gpm/ft^2) to 13.9 mm/min (0.34 gpm/ft^2)
160 (11.2)	13.9 mm/min (0.34 gpm/ft^2) to 15.5 mm/min (0.38 gpm/ft^2)
200 (14.0)	15.5 mm/min (0.38 gpm/ft^2) to 18.0 mm/min (0.44 gpm/ft^2)
240 (16.8)	> 18.0 mm/min (0.44 gpm/ft^2)

*Based on the sprinkler flow equation $Q = K\sqrt{P}$, where Q is the flow, K is the K-factor of the sprinkler, and P is the pressure at the sprinkler, and a coverage area per sprinkler of 9.3 m^2 (100 ft^2)

In-Rack Sprinklers, used in combination with ceiling sprinklers, can apply water directly on to the burning commodity within storage racks, minimizing the water needed from the ceiling sprinklers. These are usually ordinary temperature rated, standard or quick response sprinklers having K-factors of 80 (5.6) or 110 (8.0). Although the combination of ceiling sprinklers and in-rack sprinklers is an effective method of protection, in-rack sprinklers add cost and maintenance to the system as well as limit the flexibility of building storage configurations.

Large Drop Sprinklers

As storage technology changed and new materials developed, storage heights increased and commodities became more hazardous. High challenge fires associated with these new types of storage occupancies produced fires with large quantities of hot gases at high velocities, and thus, higher fire plume momentum. The large drop sprinkler was specifically developed for these high fire challenges. The large drop sprinklers, which have a K-factor of 160 (11.2), were designed to produce droplets of increased mass and corresponding velocity for effective plume penetration, attacking the fire at the source and relying less on prewetting. This was the first sprinkler that enabled the elimination of in-rack sprinklers. Their use has decreased within recent years with the advent of ESFR technology, but still offer advantages when used in cold storage areas. These sprinklers can be installed on dry and double interlock preaction systems.

Early Suppression, Fast Response (ESFR) Sprinklers

Early suppression fast response (ESFR) sprinklers are the only sprinklers listed/approved as suppression-mode sprinklers. The concept of ESFR protection is such that if a sufficient quantity of water can be delivered on to the burning commodity at the early stage of fire development, the fire can be suppressed quickly before a severe fire challenge occurs.

The suppression capability of ESFR sprinklers is a function of the size of the fire when the sprinkler operates, rather than a direct function of the burning characteristics of the protected commodity within a designated area. This is critical to the success of an ESFR system. The discharge spray of ESFR sprinklers is of sufficient momentum and density so that it effectively penetrates the fire plume and delivers a sufficient quantity of water directly to the burning fuel commodity. Benefits unique to ESFR sprinklers include superior performance and operational flexibility in accommodating changing commodities and storage arrangements.

Within recent years, several types of ESFR sprinklers have emerged to meet the challenges of the built environment, to add flexibility of installation and enhanced design features. Typical K-factors for ESFR sprinklers are both pendent and upright K=200 (14.0), and pendent K=240 (16.8), K=320 (22.4) and K=363 (25.2). The K=320 (22.4) and K=363 (25.2) ESFR sprinklers can protect buildings up to 13.7 m (45 ft) in height with up to 12.2 m (40 ft) storage heights, without the use of in-rack sprinklers and at lower pressures than a K=200 (14.0) ESFR. The K=200 (14.0) and K=240 (16.8) ESFR sprinklers may only protect this type of scenario when used in combination with one level of in-rack sprinklers at a minimum pressure of 6,2 bar (90 psi).

ESFR sprinklers may be the answer for some applications but simply cannot be used for others. A heightened awareness is necessary of the unique limitations and applications of ESFR sprinkler technology. Careful planning and coordination by the various disciplines is essential for the successful installation and performance of this type of sprinkler system.

SUMMARY

More than ever before, there are many types of storage sprinklers to choose from and the list is increasing. The development of larger orifice storage sprinklers and the expansion of ESFR technology enable more effective and feasible fire protection for these challenging occupancies. It is important that the application, limitation, and installation criteria for these types of sprinklers be understood and that the applicable documents pertaining to their use be followed.

REFERENCES

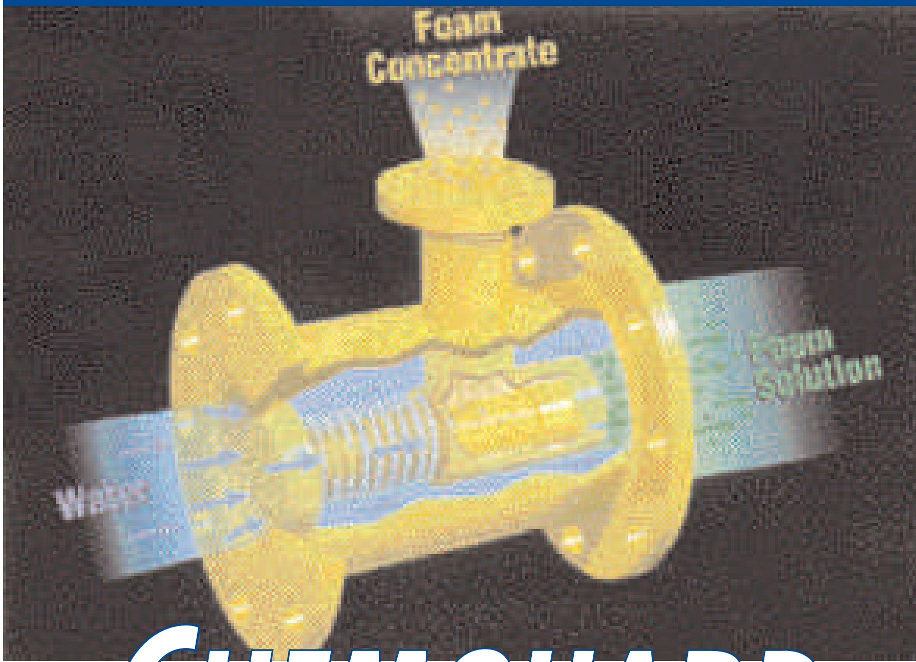
NFPA 13, 1999 edition, *Standard for the Installation of Sprinkler Systems* National Fire Protection Association

NFPA Fire Protection Handbook, 18th Edition National Fire Protection Association, 1997

Isman, Kenneth, "Sprinkler Protection for Warehouse and Storage Occupancies" National Fire Sprinkler Association, 2001

FM Global Data Sheet 2-2, "Installation Rules for Suppression-Mode Automatic Sprinklers" FM Global, September, 2001

Salvatore J. Izzo, P.E. is a Technical Services Manager with The Reliable Automatic Sprinkler Company in Elmsford, NY. He has a B.S. degree in Fire Protection Engineering from the University of Maryland and is a registered professional fire protection engineer in the State of Connecticut with 10 years experience in the fire protection industry.



CHEMGUARD
Ultra Wide Range Foam Proportioners

Since liquid foam concentrates have been used in fire protection systems one component has had a very limiting effect on system design. These devices, either inline eductors or ratio controllers (also called proportioners) have only been avabiable in certain flow ranges.

The latest device used to proportion foam liquid concentrate with water was the ratio flow controller typically called a proportioner. The proportioner is designed to meter the correct amount of foam liquid concentrate into the water stream over what, up to now was considered a wide range of flow and pressures. These devices are used in conjunction with either a bladder tank or a foam pump proportioning system. When these proportioning systems would supply closed head type sprinkler systems, the proportioner would have to be sized to operate at the maximum system flow rate, thus the system wouldn't operate properly until the flow rate through the system reached the minimum flow rate the proportioner was rated for. Therefore on large systems a large number of heads would have to open before fire extinguishing quality foam solution would be obtained. During which time, some foam liquid concentrate was being consumed by the system without any fire extinguishing taking place. In most circumstances non-fire extinguishing liquid being discharged would actually help spread the fire, contributing to escalation in the fire.

On systems using several different discharge devices such as hose reels and foam chambers several different proportioners might have to be provided in order to cover all the possible flow rates required.

Recently Chemguard has introduced a new type of proportioner that has been developed, engineered and independently tested and certified.

The new proportioner is the Chemguard Ultra Wide Proportioner, it is revolutionary in design with a flow range never before obtainable. The Ultra Wide Proportioner consists of a water float operating in a tapered throat against a stainless steel spring. The water float is attached to a hollow shaft with a slotted orifice in the side of the shaft, which is exposed to the foam concentrate liquid inlet as the water float is depressed by increased water flow, allowing foam concentrate to enter the water stream through the center of the shaft. As the water flow pushes the float deeper more of the foam liquid orifice is exposed allowing more foam concentrate into the water stream. The concentrate injection into the water stream is accomplished due to the water pressure at this point being lower than the foam pressure as a result of the pressure drop across the water float. In operation, the water entering through the water inlet moves the water float in the tapered throat to a level entirely dependent upon the discharge requirements of the system and nozzles. There are no electronic components to fail and the number of moving parts are limited to one for increased reliability, and eliminating any maintenance. The proportioner is accurate over a flow range of 20 to 2500 GPM! This type of fire extinguishing performance has never been available to fire protection designers and engineers before.

The Chemguard Ultra Wide Proportioner is a balanced pressure device, requiring the use of a bladder tank or foam pump system.

The Ultra Wide Proportioner ensures that a pre-specified and correctly proportioned foam water solution will be discharged immediately upon activation of closed head sprinkler systems, dramatically improving the fire extinguishing efficiency of these systems. This device brings unparalleled performance standards to closed head sprinkler systems!

Not only has the Chemguard Ultra Wide Proportioner revolutionized the sprinkler industry, but has provided real cost savings in other types of systems as well. Now, a single proportioner can provide correct proportioning for anywhere from one up to *forty* 60 GPM hose reels on shipboard. Providing large savings in not only foam proportioning hardware, but piping and installation labor. A single proportioner can be used to supply both foam chambers and supplmittal hose reels on tank farms.

The Chemguard Ultra Wide Proportioner is completely constructed of brass and stainless steel offering a device capable of operating in any corrosive atmospheres including salt water systems. The Chemguard Ultra Wide Proportioner is available in one size, six inches. This size is required to be able to obtain the maximum of 2500 GPM. Chemguard Ultra Wide Proportioner has very low-pressure loss considering its advantages in flow range. The Chemguard Ultra Wide Proportioner simply fits between two six inch 150# flanges and has a two-inch 150# flange foam inlet connection

The Chemguard Ultra Wide Proportioner has been tested and certified by Underwriters Labs and Factory Mutual.

This is indeed the proportioner of the future, and it is here today.

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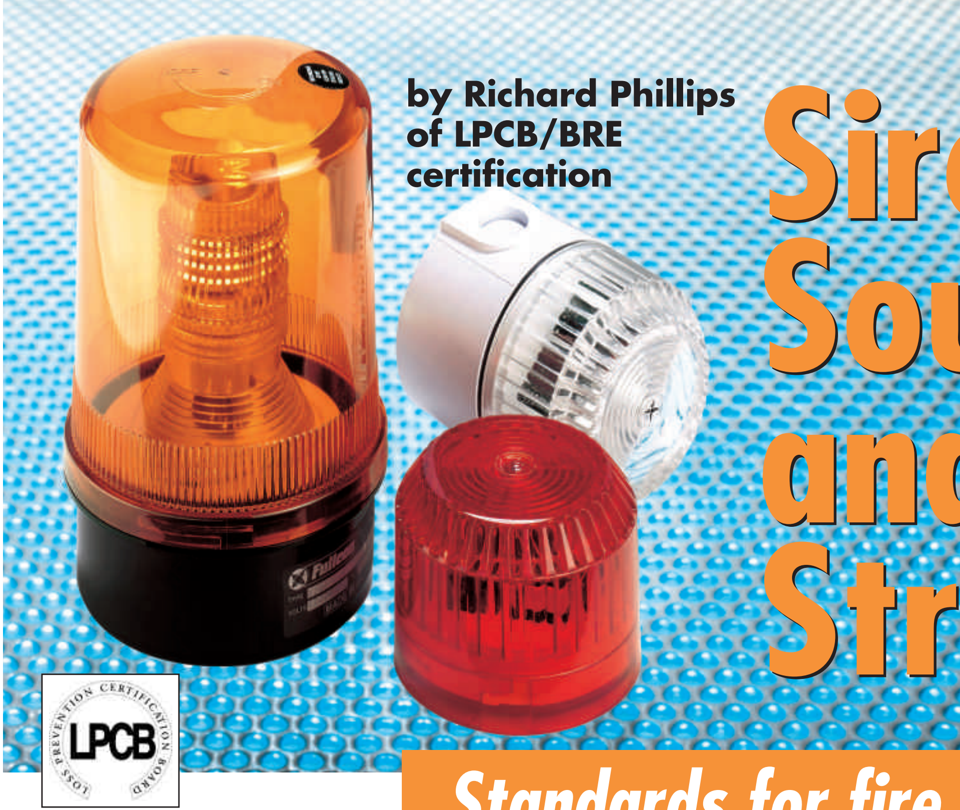


Pic: courtesy of Fulleon

by Richard Phillips
of LPCB/BRE
certification

Sirens, Sounders and Strobes

Standards for fire alarm devices

IT IS PERHAPS SURPRISING THAT, although the first British Standard for heat sensitive detectors for automatic fire alarm systems in buildings was published in 1959, the first British standard for the audible fire alarm devices (i.e. sounders), for the same systems, was only recently published, in 2001. There is still no standard for visual alarm devices although work is now progressing on this subject. Hence, fire alarm devices on the UK market have been largely unregulated, only needing to meet a few performance requirements implied by the installation code of practice BS 5839-1.

However, the European Commission's Construction Products Directive (CPD) covers the components of fire detection and fire alarm systems, including audible and visual alarm devices. This requires that, once an appropriate harmonised standard becomes available, all such components have to be certified in accordance with the standard and bear CE marking.

EN 54: PART 3

The standard for sounders mentioned above is BS EN 54-3, which is the British Standard version of the European Standard EN 54-3 and the harmonisation process for this standard is now well advanced. In fact the infamous "Annex ZA", which is required for the standard to be harmonised, recently received a positive vote in the CEN voting procedure.

The consequences of this are that all sounders falling within the scope of the standard, and placed on the market in Europe, will soon have to be certified in accordance with the standard by an appropriate notified body.

Therefore, it is a good time to review the contents of this standard and to discuss the consequences of its publication.

SCOPE

I think it is useful to start by looking at precisely, what is, and what is not, covered by the scope of the standard:

- It includes, "requirements, test methods and performance criteria". However the performance criteria are included in a somewhat flexible manner, as discussed later.
- It includes, "audible fire alarm devices in a fixed installation intended to signal an audible warning of fire between a fire detection and alarm system and the occupants of the building".
- It includes, "devices which derive their operating power by means of a physical electrical connection to an external power supply such as a fire alarm system". Presumably this excludes self-contained smoke alarms and radio controlled sounders.
- It includes two application types, Type A for indoor applications and Type B for outdoor applications.
- It excludes, "loudspeakers type devices primarily intended for emitting emergency voice messages". Presumably this means loudspeakers for voice alarm systems. However, it is not quite clear what "primarily" really means here, as such systems generally also give the alarm tones as well voice messages and it does not define which is the *primary* signal.
- It excludes, "supervisory sounders, for example, within the control and indicating equipment". i.e. the change-of-state sounders in CIE and repeater displays etc.

Hence the standard applies to the vast majority of bells, sirens and electronic sounders commonly used as fire alarm devices, including sounder bases and loop powered sounders.

WHAT SOUND IS REQUIRED?

Although it may appear that such a standard should specify the precise sound signals to be made by the sounders, this has not been possible. For the time being, it seems that it is not even possible to agree a specified evacuation signal throughout Europe. The standard does not therefore specify the signal but allows this to be defined by the manufacturer. It does, however, require the manufacturer to declare the main sound frequencies, frequency ranges and sound patterns, so that specifiers can choose appropriate devices from the manufacturers data.

It is also recognised that sounders with quite different sound output levels are required. For instance, in some applications it may be necessary to cover a large area with a single sounder giving a high output level, whereas in others it may be better to provide a larger number of sounders with lower output levels. The standard does not, therefore, specify specific sound output levels but requires that manufacturers declare these levels and it defines how these levels should be declared. This is intended to allow the

declared specification to be confirmed during the testing, to ensure that sufficient data is provided for the system designers to determine the requirements for a particular installation and to allow meaningful comparison between products from different manufacturers.

SOUND LEVEL SPECIFICATION AND MEASUREMENT

The standard requires the manufacturer to specify the minimum sound level, under anechoic/free-field conditions, 1 metre from the device at 30° intervals, in both the horizontal and vertical planes. For surface mounted (e.g. wall mounted) devices, this is required at angles between 15° and 165° to the surface, and for pole mounted devices it is required through the full 360°.

In order to relate the sound levels to human sound perception, they are recorded as an A-weighted value (dB(A)) and, for fluctuating signals, the value recorded is the maximum value measured during a complete cycle of the sound pattern with the meter set to the F (Fast) detector characteristic.

To reduce measurement errors, such as those introduced by the determination of the reference point, the measurements are made at a 3 m distance, but to conform with common practice the this is converted to a value at 1 m for the specification.

These measurements are made at the maximum and minimum of the supply voltages range(s) specified for each mode or tone provided by the device.

It should be noted that this is considerably more data than is generally given in current specifications, which often only give a value for the sound level 1 metre directly in front of the device. For modern programmable devices with many modes, and often two supply voltage ranges, this can be a significant amount of data.

The sound level measured at each of the specified angles must not be less than that specified by the manufacturer and for any angle the difference between the level measured at the maximum and minimum supply voltages must be less than 6 dB.

In the draft for comment, no absolute limits were specified for these levels. However, a number of comments were received requesting that at least absolute minimum and maximum levels are specified. A minimum level of 65 dB(A) in at least one direction has therefore been included, as this appeared to satisfy most European application guidelines, and a maximum level of 120 dB(A) in any direction was included to reduce the possibility of permanent hearing damage.

CONSTRUCTIONAL REQUIREMENTS

The standard includes a number of requirements on the construction of the audible alarm devices:

- There must be adequate provision for the external conductors to enter the enclosure, sufficient space within the enclosure for terminating these conductors and secure terminals to accommodate conductors between 0.28 mm^2 and 1.5 mm^2;
- The constructional materials must be capable of withstanding the environmental conditioning specified in the standard and shall have the following flammability ratings depending upon the supply voltage and power consumption:
  - ISO 1210 Class FV-2 or FH-2 for supplies < 30 Vrms or 42.4 Vdc and < 15 W;
  - ISO 10351 Class LFV-1 for supplies ≥ 30 Vrms or 42.4 Vdc or ≥ 15 W;
- The enclosure must provide the following protection:
  - IP 21C for Type A (indoor use);
  - IP 33C for Type B (outdoor use);
- Means shall be provided to limit access for the removal of parts or the whole device, and to make adjustments. This could be, for example, by the use of special tools or codes or the provision of hidden or sealed screws.

MARKING AND DATA

The marking requirements are similar to other components of fire detection and fire alarm systems. The marking on the device must include the following:

Climatic Tests

TEST	Severity Type A (indoor)	Type B (outdoor)
Dry heat (operational)	Temperature: 55°C Duration: 16 h	Temperature: 70°C Duration: 16 h
Dry heat (endurance)	No test	Temperature: 70°C Duration: 21 days
Cold (operational)	Temperature: –10°C Duration: 16 h	Temperature: –25°C Duration: 16 h
Damp heat, cyclic (operational)	Lower temp: 25°C, >95%RH Upper temp: 40°C, 93%RH Cycles: 2	Lower temp: 25°C, >95%RH Upper temp: 55°C, 93%RH Cycles: 2
Damp heat, steady state (endurance)	Temperature: 40°C Humidity: 93%RH Duration: 21 days	Temperature: 40°C Humidity: 93%RH Duration: 21 days
Damp heat, cyclic (endurance)	No test	Lower temp: 25°C, >95%RH Upper temp: 40°C, 93%RH Cycles: 6
SO_2 Corrosion (endurance)	Temperature: 25°C Humidity: 93%RH SO_2 conc: 25 ppm Duration: 21 days	Temperature: 25°C Humidity: 93%RH SO_2 conc: 25 ppm Duration: 21 days
Water ingress	IPX1 (Vertical dripping)	IPX3 (Spray to ± 60∞ from the vertical)

- the number of the standard (i.e. EN 54-3);
- the environment type; Type A for indoors and Type B for outdoors;
- the name or trademark of the manufacturer or supplier;
- the model designation;
- the terminal designations;
- the rated supply voltages or voltage ranges;
- the power and current consumption;
- a mark or code (e.g. serial or batch number) by which the manufacturer can identify at least the date or batch and place of manufacturer and the version number of any software contained within the device.

It is also required that the device is supplied with sufficient data for its correct usage and, as indicated earlier, this data must include the specified sound level and directional data for the device and the main sound frequencies and the frequency and temporal pattern of the sound signal.

COMPARATIVE SOUND LEVEL MEASUREMENTS

Free-field/anechoic measurements, as described above, are required to check that the manufacturer's specification for the sound output is met. However, during the other testing in the standard it is necessary to make many measurements, which are only used as relative measurements (e.g. to determine the reproducibility of the sound level from one specimen to another and the stability of specimens under different conditions). For these measurements, it is expensive and unnecessary to repeat the full free-field measurements and the standard therefore introduces a smaller scale measurement procedure in a reverberant chamber, to make comparative sound output measurements.

Pic: courtesy of Vimpex

DURABILITY

The standard includes a durability test to ensure that the sound out put level does not deteriorate significantly after prolonged operation. For this, the sound output level is measured by the comparative method. The specimen is then subjected 100 times to a 1 hour ON: 1 hour OFF durability cycle. During the ON period the specimen is supplied with the maximum specified supply parameters in the mode of operation which consumes the most power. After the 100 cycles the sound output is measured again and must not have reduced by more than 6 dB.

Mechanical Tests

TEST	Severity Type A (indoor)	Type B (outdoor)
Shock (operational)	Pulse: Half sine Duration: 6 ms Acceleration: $(1000\text{-}20M)ms^{-2}$, For mass $M \le 4.75$ kg No test for mass $M > 4.75$ kg No. pulses: 3 in each of 6 directions	
Impact (operational)	Impact Energy: 0.5 J No. Impacts: 3	
Vibration (operational)	Frequency range: 10 to 150 Hz Acceleration: 5 ms^{-2} Sweep rate: 1 octave/min No. axes: 3 No. Sweep cycles: 2/axis/functional condition	
Vibration (endurance)	Frequency range: 10 to 150 Hz Acceleration: 10 ms^{-2} Sweep rate: 1 octave/min No. axes: 3 No. Sweep cycles: 20/axis	
Mechanical ingress	IP2XC	IP3XC

ENVIRONMENTAL TESTS

The environmental test schedule for the audible alarm devices is taken from the CEN Catalogue of environmental tests and incorporates severities for both indoor (Type A) and outdoor (Type B) devices. The severities for these tests are summarised in the tables.

The device shall be subjected to the following electromagnetic compatibility immunity tests as described in EN 50130-4: 1995. These tests shall all be applied in the quiescent state and the radiated and conducted RF tests shall also be applied while the device is sounding.

VOICE SOUNDERS

As hinted in the discussion of the scope of EN 54-3, it is not clear if "voice sounders" are really included in or excluded from the scope. Generally voice sounders have a message broadcast sequence similar to that specified in BS 5839-8 for voice alarm systems. This consists of an attention drawing signal/tone followed by a pre-recorded voice message. If the voice message is considered to be the primary signal then the devices are excluded. However, if the tone is considered to be the primary signal and device is considered to be a "voice enhanced sounder", as they are sometimes called, then they are included.

I am sure that it was not originally intended to include these devices in EN 54-3 and the problem with including them is that there are no requirements for the voice message or the broadcast sequence. The CEN working group responsible for alarm devices is currently considering how to deal with voice sounders. The group is considering what additional requirements are necessary but it is not yet decided if these will be included into an amended EN 54-3 or into a separate standard.

One point that has become clear is that if voice sounders are operating in close proximity, it will be necessary to synchronise their operation, if the voice message

Electromagnetic compatibility Tests – EN 50130-4

Port	Environmental Phenomena	Severity (Types A and B)	Basic Std.
Enclosure	Radiated RF	80 to 1000 MHz 10 V/m 80% AM (1 kHz sin.) & 1 Hz Pulse mod.	IEC 1000-4-3 EN 61000-4-3
	Electrostatic Discharge	6 kV contact discharge 8 kV air discharge	IEC 1000-4-2 EN 61000-4-2
DC, low voltage & Signal lines	Voltage variations	†	†
	Conducted RF	0.15 – 100 MHz 10 V (140 dBμV) 80% AM (1 kHz sin.) & 1 Hz Pulse mod.	ENV 50141
	Fast transients	1 kV (peak) 5/50 ns T_r/T_h pulses 5 kHz Rep. frequency	IEC 1000-4-4 EN 61000-4-4
	High energy voltage surge	1 kV line-to-ground** 1.2/50 ms T_r/T_h pulses	IEC 1000-4-5 EN 61000-4-5

* Via 10 Ohm series resistor. ** Via 40 Ohm series resistor.
† Included in the sound level measurements.

is to be intelligible. Requirements for this synchronisation are currently being drafted and it is proposed to add these to the standard as an option with requirements.

VISUAL FIRE ALARM DEVICES (E.G. STROBES/FLASHING BEACONS ETC.)

There is currently no British or European standard for visual fire alarm devices. However the same CEN working group is preparing a first draft based on EN 54-3 but with optical measurements replacing the various acoustic measurements.

It is likely that, for strobes using xenon flash tubes, the measurement of the performance of the flashing light will be based on the Blondel-Rey law and will therefore be somewhat similar to the method used in UL 1638 and UL 1971. However, it appears that other techniques may be required for devices with longer duration flashes.

It is also clear that where a number of devices may be in view at the same time there could be requirements to ensure that the flashes are synchronised. It is therefore also intended to add this as an option with requirements, as for voice sounders.

Richard Phillips, Technical Director (Electronics) at BRE Certification, has been involved with the testing, approval and the development of standards for fire detection and fire alarm, equipment for over 25 years.

For further information concerning the implementation of the Construction Products Directive, the standards or approvals for sounders and strobes or indeed any fire or security related equipment please contact us at LPCB/BRE Certification (+44 (0)1923 664100), visit our website at www.brecertification.co.uk or visit our stand at one of the following exhibitions:

IFSEC, NEC, Birmingham 13th – 16th May (stand no. C134)
NFPA, Minneapolis, Minnesota 20th – 22nd May (booth no. 1753)

Electrical Requirements for Fire Pump Controllers

Pic: courtesy of Joslyn Clark

by **R. Schneider, P.E.,**
Consultant to Joslyn Clark Controls, LLC

IN OUR MIND'S EYE, most of us can visualize a team of horses galloping through narrow streets pulling a buckboard with a tank of water and a couple of firemen on the way to a fire. Indoor plumbing and electric power distribution were not yet available. Actually, this mid-19th century system worked fairly well as long as the firemen did not tire out at their treadle pump before the tank was emptied or the fire was extinguished. The firemen were the power supply. Fairly reliable! That was then. But now it's different – way different.

In the art and science of fire protection, reliability is paramount!

One thing we all agree on is that when the building is on fire and a signal is sent to the Electric Fire Pump Controller (EFPC) to start the fire pump motor, we expect immediate response. In order for that expectation to come true, we need reliable power, not only when the pump starts but also for the duration that the fire is being fought. NFPA 20 (1999) defines a reliable power source as one that possesses the following characteristics:

1 **Infrequent power disruptions from environmental or man-made conditions**
2 **A separate service connection or connection to the supply side of the service disconnect**
3 **Service and feeder conductors either buried under 2 in (50mm) of concrete or encased in 2 in (50mm) of concrete or brick within a building.**

Point (1) above leaves room for interpretation and that burden falls on the AHJ, (Authority Having Jurisdiction). NFPA 20 defines the AHJ as "*the organization, office or individual responsible for approving equipment, an installation or a procedure*". In practice, this could be the building owner, the insurance carrier, the fire marshall etc.

When the AHJ judges the primary (normal) power supply to be less than reliable he will additionally require an alternate supply to which the fire pump controller automatically switches when the normal source fails. This is accomplished by the use of an automatic power transfer switch. The installation of a diesel engine driven fire pump is another way of satisfying the AHJ.

Point (2) above recognizes that it is standard practice for firemen to "kill incoming power" to the building before

Pic: courtesy of Joslyn Clark

fighting the fire with their hoses. In order to minimize inadvertent disconnection of the fire pump, standards like IEC 60364-5-56 and NFPA 70 encourage the service conductors feeding the fire pump to be brought directly to the fire pump controller which then acts as the "service". If that is not possible, these Codes permit one "service disconnect feeding the fire pump" to be located remote from the FPC but separate from the building disconnects and identified as such.

All EFPC's must be equipped with a voltage surge arrester or be able to withstand a 10,000V impulse without damage. This is to minimize damage from lightning strikes of the incoming power.

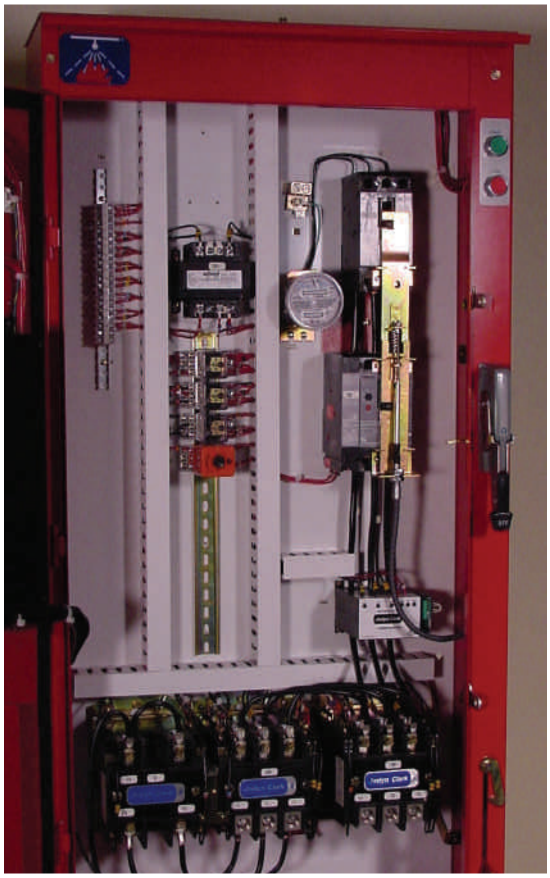
Point (3) above requires feeders from the remote service disconnect, as well as service conductors feeding the fire pump going through the building, to be buried under 2 in (50mm) of concrete or brick. This is to provide additional protection to these conductors from heat and falling debris during a fire.

Standards covering Electric fire pump controllers, such as NFPA 70 and NFPA 20 require electric power sources to have sufficient capacity to limit the voltage drop at the controller line terminals to 15% max. under motor starting conditions. Further, these standards mandate power delivery system to be of sufficient capacity so as not to have the voltage drop more than 5% below voltage rating of the motor when the motor is running at its service factor (115% of full load current). There are good reasons for those limits.

The –15% voltage limitation at the line terminals during starting is harmonized with IEC 60947, UL 508 as well as NEMA standards which pertain to electro-mechanical equipment (controlgear) that is used in Electrical Fire Pump Controllers. The –5% voltage limitation at the motor is to prevent motor winding overheating. It is important to remember that these limits include voltage losses in the controller, the conductors and the power transformer and thus, often, result in the need to use oversized power transformers and cables. These decision often increase the short circuit availability at the line terminals of the controller. !00,000, 150,000 or even 200,000 RMS Symmetrical Amperes short circuit availability is not unusual.

These voltage limits are also of concern when two power sources are mandated. When the power transfer switch (mentioned earlier in this article) is part of the fire pump controller it is generally in its dedicated, barriered compartment. This switch is programmed to favor the Normal Power Source and will keep the controller connected to that source until the voltage drops below 85% of nominal rating, when that source becomes discontinuous or when the frequency drifts more than 1% from normal. When any of these monitored limits are exceeded, the transfer switch declares that source to be corrupted and initiates transfer action. When the alternate power source is a standby generator, the automatic transfer switch will first initiate a diesel engine start signal (battery power) and will wait until that alternate source

All EFPC's must be equipped with a voltage surge arrester or be able to withstand a 10,000V impulse without damage. This is to minimize damage from lightning strikes of the incoming power.



Pic: courtesy of Joslyn Clark

Electrical Requirements for Fire Pump Controllers

produces power within acceptable limits. It then transfers to connect the EFPC to that source. When the alternate source is a live source such as a 2nd utility or on-site power, the diesel starting steps are omitted and transfer is initiated without delay as long as the voltage is 90% of rated voltage or higher. Regardless of the nature of the alternate source, while the transfer switch is in the alternate position, it continuously monitors the normal source. When, the voltage and frequency becomes normal for a continuous 30 minutes period, the transfer switch will automatically switch back. Under that condition, when the alternate supply is a generator, the transfer switch will keep the unloaded diesel engine running for 5 minutes' "cooldown" before shutting it down. Most transfer switches are programmed to ignore momentary normal source outages shorter than 3 seconds.

Pic: courtesy of Joslyn Clark

SACRIFICIAL EQUIPMENT AND CONDUCTORS

It is not unusual that under-exercised centrifugal fire pumps accumulate contaminants such as sand and rust in the impeller housing. Of primary concern is to get that fire pump going when needed and not necessarily to protect the motor and conductors. FPC standards such as (prop) IEC 62091 and NFPA 20 mandate that the overcurrent protective device in the EFPC be sized to not trip up to 300% motor full load current. These Codes and Standards permit only locked rotor and short circuit protection in the FPC – no overload and no ground fault protection. No protective device can be thermally reactive and reset after tripping must be able to be accomplished without time delay. Locked rotor protection must be set to permit 8-20 seconds of locked rotor current to flow before tripping the FPC breaker. This is to afford a distressed centrifugal pump ample time to get up to speed. Installation Codes such as Section 695 of NFPA 70 therefore mandate that circuit protective devices electrically upstream and remote from the FPC When used) may offer short circuit protection but must not trip under locked rotor conditions which is assumed to be 600% motor full load current. The reason for this is that this upstream equipment may be on the other side of the fire line and thus inaccessible during a fire. Short circuit coordination with the FPC circuit breaker, which is set up to 20 times motor full load current, is required. Only one upstream disconnect with overcurrent protection is permitted in the feeder circuit and that disconnect must be supervised and marked plainly that it is dedicated to the fire pump.

Another way Fire Pump Controllers differ from general industrial motor controls is that FPC's must have manual/emergency operation capabilities. In the case of transfer switches, manual switching of that switch is mandated which makes placement of that transfer switch in or near the FPC a requirement. Further, the FPC is equipped with a manual/emergency handle to permit placement of the motor directly "on line". In the USA, this is accomplished by manually closing the motor contactor to start the motor. Latching the handle in the ON position assures the continued running of the motor. When operating under manual/emergency conditions, the voltage reductions limitations mentioned earlier, are waived. Under generator-produced alternate power, the voltage must recover, and the motor must accelerate, "ultimately". This is important where the generator is sized for reduced-voltage starting and takes advantage of the fact that the contactor is held closed manually rather than magnetically.

Fire Pumps and their Fire Pump Controllers are located within sight of each other and are usually located in pump houses or pump rooms. These rooms are mandated to have 2 hours fire resistance and are expected to be able to be accessible during a fire.

In summary, circuits supplying power to fire pumps are very special in the following ways:

a) Direct connection of service conductors to the fire pump controller or
b) Service switch separate from other service switches
c) Conductor routing to be outside the building or under 2" (50mm) of concrete
d) Special voltage limits resulting in possible need for oversizing conductors
e) Only one upstream disconnect with >600% MFLC overcurrent protection
f) Special marking and supervision on remote switch
g) Locked rotor protection and coordinated short circuit protection in the FPC only.
h) Need for alternate power source if normal source is judged unreliable.

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FSSA news

McGlynn Elected FSSA President

David McGlynn was elected president of the Fire Suppression Systems Association at the group's 2002 annual meeting. McGlynn, who serves as director of operations for BFPE International's southern region and general manager of its Raleigh, N.C. branch, brings 19 years of fire protection experience to FSSA's top spot and has been active in the organization for several years.

"It's a tremendous honor to be elected president of this organization," says McGlynn, who took office during FSSA's 20th Annual Meeting. "I plan to take what we've learned from the past 20 years and implement policies and programs to ensure that FSSA is just as strong, or even stronger, for the next 20 years."

"Based on their feedback to the FSSA board of directors, members can expect significant change in FSSA's meetings and communication," he continues. "We also have aggressive agendas planned for the Technical and Education Committees to enhance those services of greatest value."

McGlynn has spent his entire career in varying capacities with BFPE International. He has been active with FSSA for eight years, chairing the Education Committee for five of them. During that time, he let the reworking of NICET's Special Hazards Certification Program. McGlynn has also played active roles with the National Association of Fire Equipment Distributors and the National Independent Fire Alarm Distributors Association.

Joining McGlynn as FSSA officers are Vice President Al Thornton of Great Lakes Chemical Corporation and Secretary/Treasurer Ray Aldridge of Orr Protection Systems. Paul Harris, Notifier, will continue on the board as immediate past president.

FSSA members service as directors for the year are Bob Burkland, Healey Fire Protection; Shawn Mullen, Protex Central, Inc.; Mike Dempsey, Southeastern Fire Control; Michele Sabah, Sabah International; Larry Grodsky, Siemens Safety Systems; John Dowd, DuPont Fluoroproducts; Dave Hoffman, Fike Protection Systems; Tim Pope, Chemetron Fire Systems; and Joe Ziemba, Ansul, Inc.

Key Initiatives for 2002 and Beyond

"The mission of FSSA is to promote the use of, and be the leading recognized authority on, special hazard fire protection systems; employing existing and new technologies to safeguard people, high-value assets and the environment."

FSSA's 2001 President Paul Harris announced the association's new mission to the membership during FSSA's 2002 Annual Meeting. He told the membership that FSSA's board of directors held a strategic planning session immediately prior to the meeting. Based on feedback from a member needs assessment survey and their own experience with the organization, the group laid out four key initiatives as FSSA moves forward.

Technical and Training Information

"FSSA installer members told us the technical information and representation FSSA provides are the membership benefits they value most," says FSSA President David McGlynn, who assumed the leadership reigns from Harris at the meeting. "We will continue to enhance the value of those services."

"At the same time, our members told us that recruiting, retaining and training quality employees is one of the greatest challenges they face," he continues. "We will explore methods by which we can deliver training more effectively and efficiently."

Annual Meeting

The second key benefit identified by members is FSSA's annual meeting. Thus, the board's next priority is to enhance the value of the meeting to members by exploring changes to content, format and location.

Communication

The third initiative identified by the board is enhancing FSSA's communications to members as well as to those who make and influence the fire protection decision.

"We want to create and increased awareness of our products among the AHJ and end user communities," says McGlynn. "We've made a strong start here with our SHAPE program. Now, we're committed to increasing our market penetration until people widely recognize the need for special hazard fire suppression systems."

Members also made it clear that FSSA didn't communicate membership benefits well enough. An enhanced member communication is also being developed.

Membership

The board's fourth initiative is to increase FSSA membership. The Membership Committee will be tasked with seeking out additional members of the suppression industry and broadening the categories of FSSA membership. FSSA will become the key source for information on needs and trends within the special hazards industry and a leading edge provider of solutions.

Moving Forward

"Our plan to date has a lot of broad statements without too many specifics," McGlynn acknowledges. "The board will be getting together again in the spring to identify specific strategies and tasks to support each goal."

McGlynn continued to say that FSSA will depend on member support to advance its goals and will announce a detailed agenda shortly.

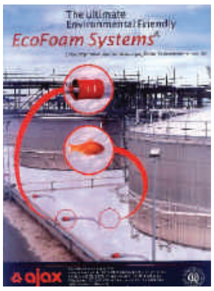
FSSA Programs Recognized for Excellence

FSSA's web site,www.fssa.net, received a certificate in the web site category of American Society of Association Executives' Gold Circle Awards program. The Gold Circle Awards recognize dedication to excellence and the achievement of high standards is association communication. FSSA's was one of nearly 1,000 entries in the contest.

The Maryland Society of Association Executives also recognized the FSSA web site as among the best association work in Maryland in its Circle of Excellence program. The group also awarded FSSA's SHAPE program a first place award in the public relations category.

"We're both honored and pleased to be recognized by our peers for quality association work," says Mitch Lebovic, FSSA's director of communications. "But what's more gratifying are the results these programs are generating. FSSA's web site is getting nearly 600 percent more traffic than before its redesign, and the SHAPE program continues to put the FSSA name before the fire protection community, end users and decision influencers."

Biological Ecofoams conquer the market



DUTCH TELECOM KPN ORDERS 10,000 ECO FRIENDLY FIRE EXTINGUISHERS.

There is now a growing awareness of the differing fire fighting foams available throughout the world. European recommendations, regulations and laws in other countries are forcing manufacturers to find environmentally friendly solutions. Governments are assisting such alternatives by acknowledging the quality of the foam, based on its biodegradability, toxicity, waterhazard, dermatological level and ingredients used. These approvals have nothing to do with A and B class ratings or the necessary technical approvals needed for each foam.

Environmental labels like "Milieukeur" in The Netherlands and "Blauen Engel" in Germany should assist clients to choose the right products for them. The environmental label is a guarantee for the user that the product bought is approved as environmentally friendly. Unfortunately the rules to receive an environmental approval do vary in each country. One problem is the fact that foam manufactures do not want to reveal their, carefully developed formulas or ingredients to outside sources. Despite the fact that alternative product tests at internationally recognized testing institutes, can prove conclusively, that products are highly biodegradable or non-toxic.

Foam manufactures and the OEM's of fire extinguishers and/or other systems, are searching for acceptable, environmental alternatives to the existing products.

A number of years ago Bioversal International developed a range of environmentally friendly products. This first generation "Bioversal QF" Ecofoam, was the very first foam in the world that received the Dutch environmental label "Milieukeur" on an extinguisher. This environmental label was granted on the products high biodegradability & non-toxicity. It was safe for both the environment and the users. Bioversal QF extinguishes are multi-functional and clean up Hydrocarbons (oil) from the environment.

Even with this environmental alternative available, there was still some hesitation from the fire extinguisher manufactures. The reason was not the environmental quality, but the gap in extinguishing ratings between traditional foams, dry powders and this eco friendly foam.

This gap was bridged when Bioversal launched the second generation of biological environmentally friendly foams for fire extinguishers. The Bioversal QF-MX and QF-MXH range was specially designed for fire extinguishers with the purpose of solving this difference in the rating levels.

Successfully, Bioversal reached a much higher level in Class A and B ratings with this second generation, without loosing its special features of fast biodegradability (>98% in 8 days), non-toxic, pH-neutral and water hazard classification 1.

Once again, Bioversal received the Dutch environmental certificate, for this new generation of foam. The door is now open for all manufacturers to bring an "environmentally friendly" alternatives on the market.

The balance between the required performance and the environmental issues, has meant a great number of European manufactures like Gloria Werke, Ajax, Bavaria and Abex, have added to their existing range of products with this new ecofoam. The boost in volume of this new generation proves that clients are aware and appreciate the environmental solutions offered.

Multinationals like Dutch Telecom KPN switched over to these newly offered eco friendly foams and recently ordered 10,000 Ajax green fire extinguishers with the Bioversal ecofoam. Also the Academic Hospital in Groningen, The Netherlands, made the switch to environmental friendly extinguishers recently, this demonstrates that environmentally friendly fire-fighting foam is now a reality.

For more information, please contact:
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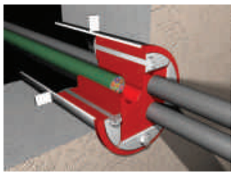
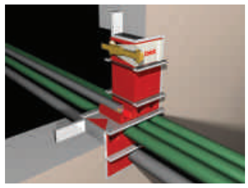
How do you feel entering a tunnel by car?



FIRE PROTECTION OF CABLE AND PIPE INSTALLATIONS.

The scene: A highway in the Austrian Alps. Many bends, many gradients, steep roads and – many tunnels. The roads leading from North to South are used by too many trucks, often driving at high speed with too short a distance between them. When entering a tunnel the pulse rate of the driver increases automatically. Consequently, also the nervousness and impatience among the sometimes tired truckers increases. One could possibly go by 0.5 km/h faster! Distance between the trucks becomes shorter. A tiny inattentivness or heated brakes and 70 tons of rolling bombs crash into each other. Within the narrow tube, 24 cars get stuck and a truck carrying barrels of varnish explodes. It takes only seconds and the tunnel becomes a hot furnace of 1200°C; a toxic, black cloud of smoke is released into the clear Austrian mountain air. Only after 16 hours is the fire taken under control, 12 people die, 42 are seriously wounded. All this happended on May 29, 1999, in the Tauern tunnel. It is just one example of recurrent tunnel disasters and it shows more often than not that deadly fumes stop people escaping from this terrible trap.



Official authorities have tried to ease this problem by structural measures like escape tunnels, emergency exits or escape rooms. At such structural measures it is however very important that supply mains, i.e. cables, pipes or ventilation ducts have to be sealed accordingly. Demands are naturally great and varied: such a cable or pipe sealing has to be fire- and water-resistant and should prevent the spreading of toxic fumes. The technical solution also has to be maintenance-free due to the difficult accessibility (closing of lanes will be necessary). The constant pollution by exhaust fumes (carbon monoxide) necessitates the use of sealing materials which are resistant against chemicals : a perfect task for the modular bst-Sealing.

The system is simple and yet effective. bst-Frames made from angle steel are being installed into walls or floors, or they are concreted already with the framework, to fit exactly into the opening. As soon as cables or pipes are laid they are sealed by modules. Elastic blocks, the so-called "Quick Fix Tolerance Cable Modules" made from halogen-free elastomeric rubber, surround each cable/pipe separately and are compressed mechanically by a wedge unit. This system has a fire resistance of 4 hours, the material is waterproof, highly resistant against chemicals and forms a pressure-tight sealing which prevents the spreading of fumes. For later installations the sealing can be re-opened and material can be re-used for the additional cables. The bst Multi Cable Transit is a statically solid solution. Building movements and vibrations do not damage the sealing. This product has been tested and approved according to various international standards. It has been in use for many years in over- and underground constructions, in ships and offshore units and, of course, also in tunnels.

For more information, please contact:
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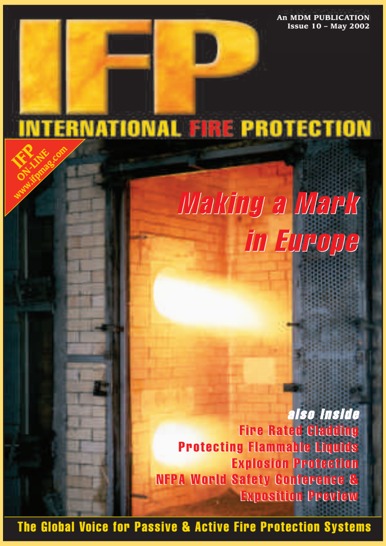

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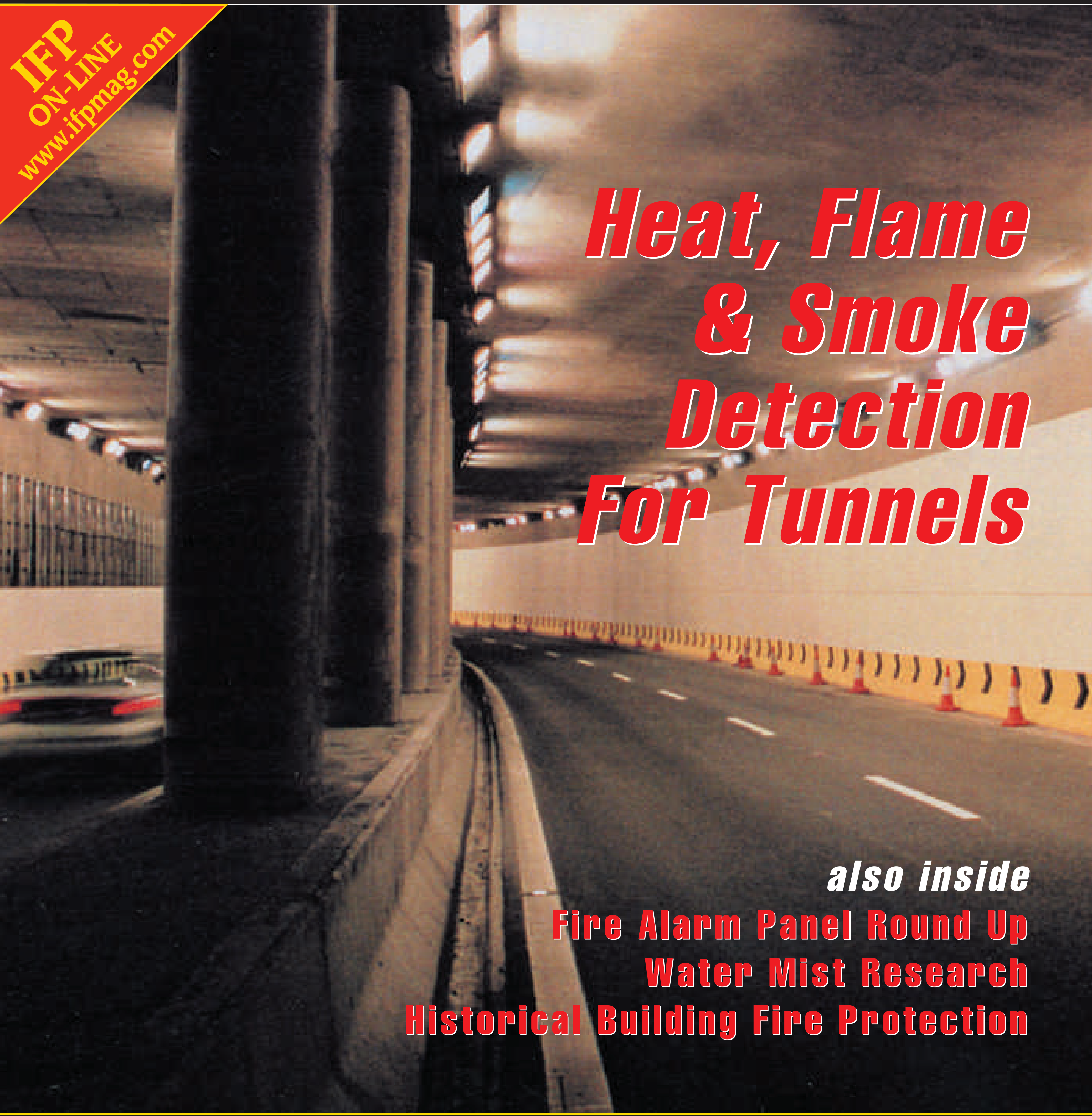

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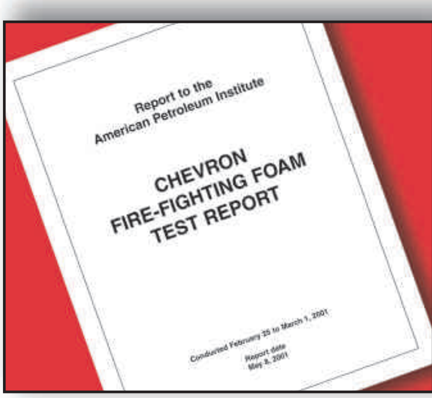

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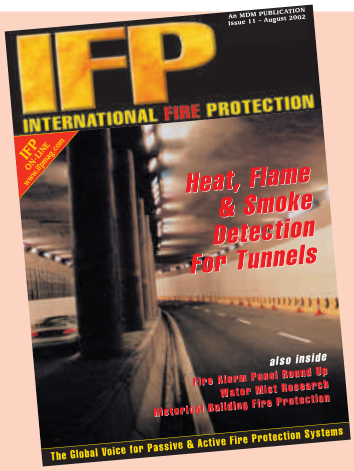

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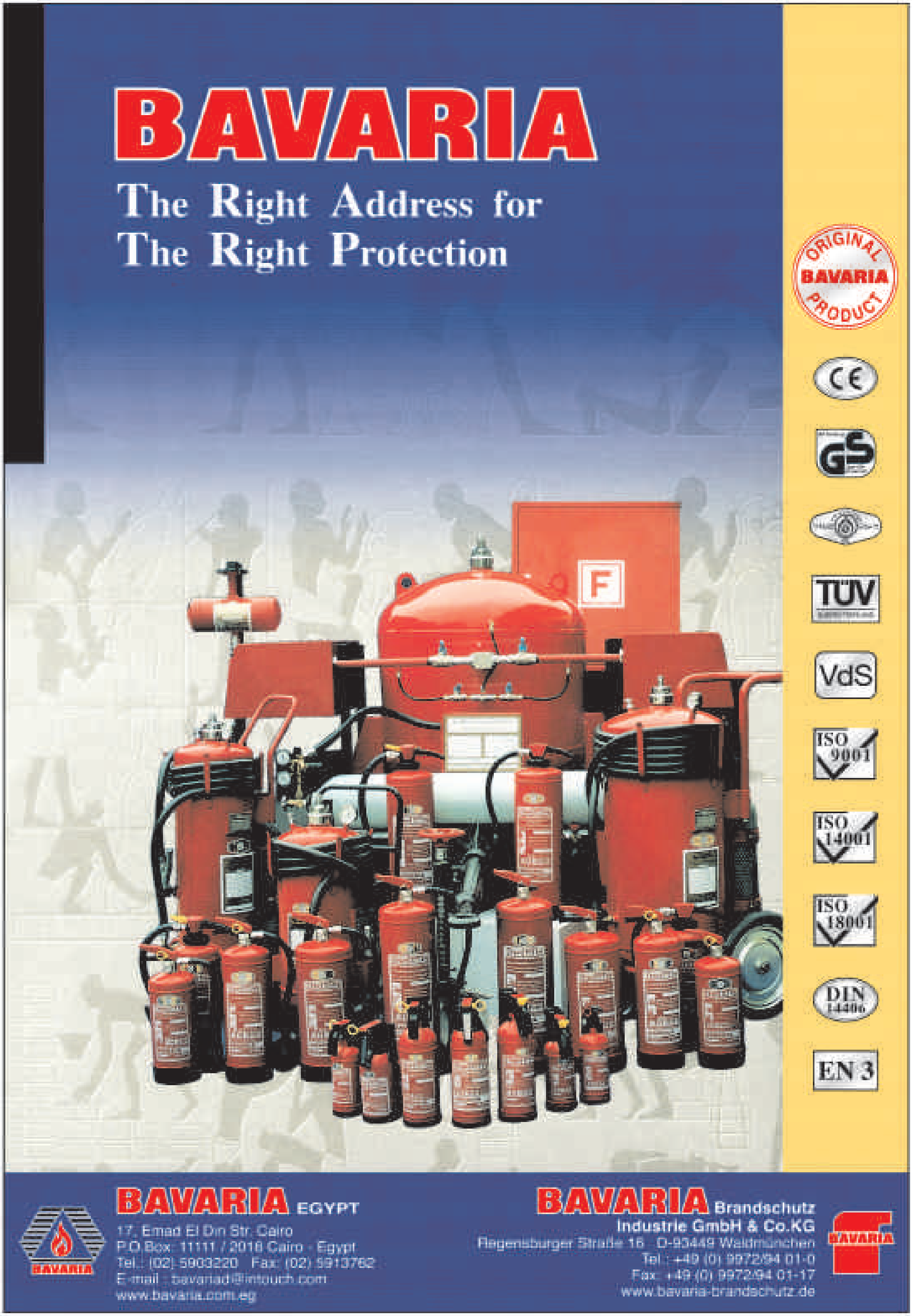

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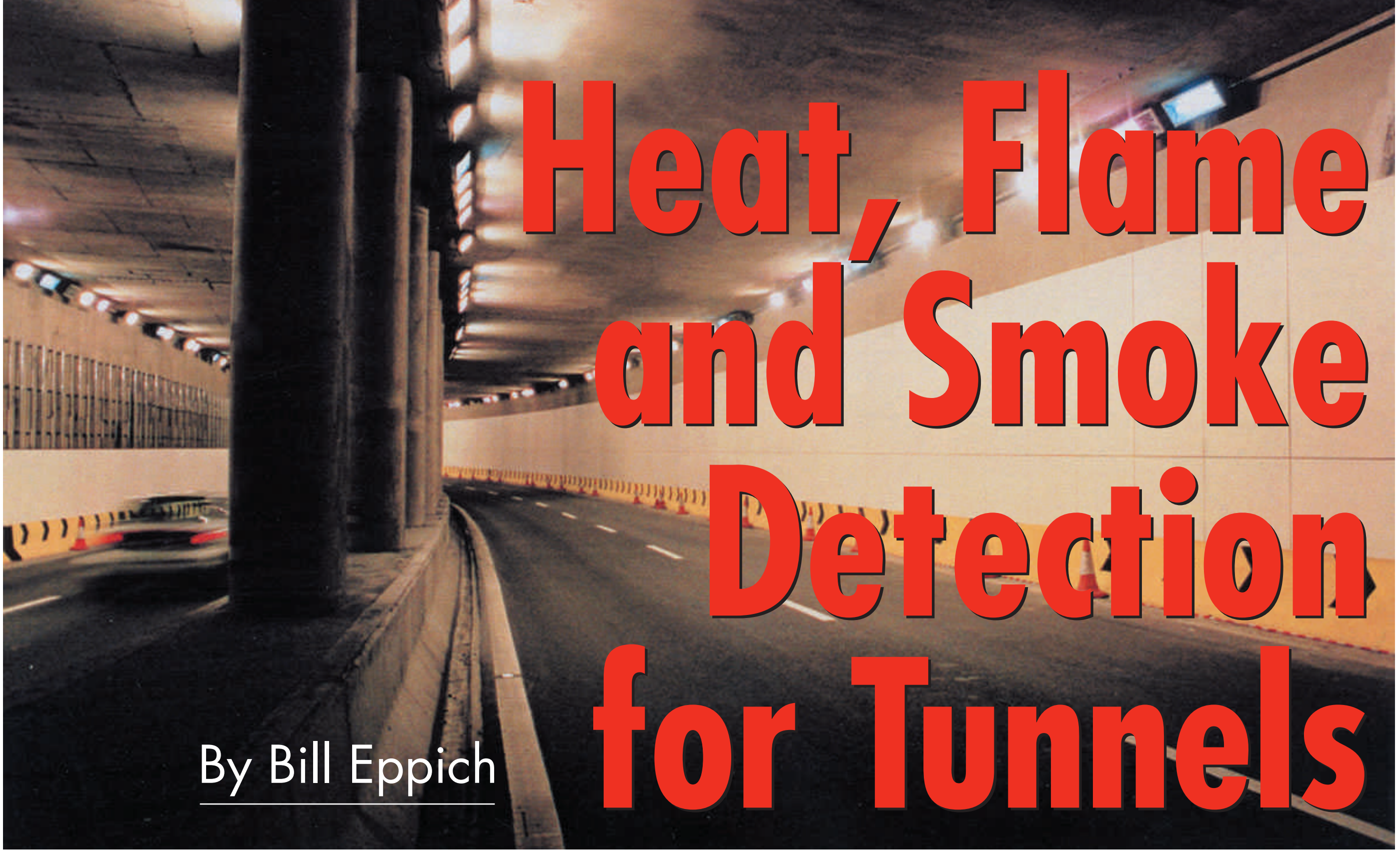


Heat, Flame and Smoke Detection for Tunnels

By Bill Eppich

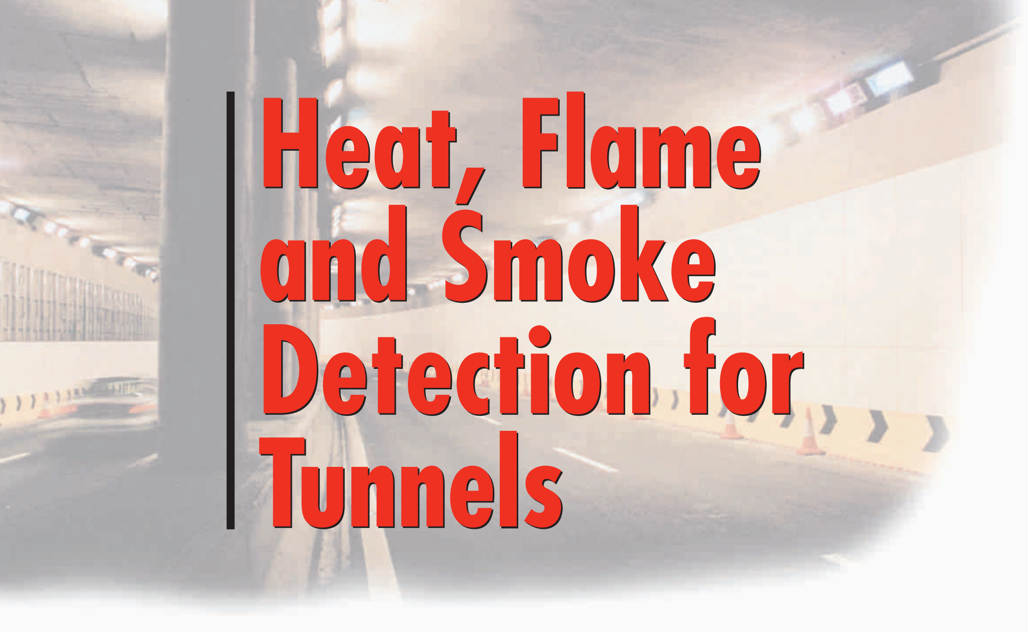
Damansara Tunnel
Pic courtesy of Eternet Asia

BROADLY SPEAKING, highway tunnel fires can involve either the tunnel structure and systems or the vehicles that pass through them. No evidence of fires involving only the tunnel structure or systems has been found as the non-flammable nature of the structure materials suggests that all highway tunnel fires will originated in vehicles and their fuel, cargo and furnishings. Tunnels will be damaged and lives lost to the extent that tunnel systems and operations cannot control the ignition hazard presented by these vehicles and the conditions brought about by a fire in a confined and often crowded tube.[1] Changes in vehicle design have reduced some sources of vehicle fires, but added new ones. The most important result of design changes in the past several years are that vehicle fires are more severe and more dangerous than in the past. As a consequence, tunnel operators can expect to encounter several vehicle fires in some years and the potential danger can be great.

Relatively little research has been carried out on the rate of fire development in the range of vehicles on the road today. Modern car fires reach an intensive level irrespective of the vehicle type, additional luggage, and load within a few minutes. The cab and engine of heavy trucks show a slower rise in spread due mainly to their trim contents and better compartmentation between engine, cab, and load. On the other hand, the close proximity of the drivers cab to the engine compartment increases risk of fire.

Vehicle fires normally progress through three definable phases whose durations vary drastically between older vehicles and those that are post 1980. The great increase in fire hazards in newer cars is apparent. In the initial stage the fire smolders or builds up heat at the point of origin where the roof will slowly increase to 200°C and eventually spread to the roof lining. In older vehicles, this usually lasts about 20 minutes. In newer vehicles, this can occur in 10 minutes or less. The origins of vehicle fires include smoking, electrical short circuits, flammable liquid leaks, arson, exhaust malfunctions and frictional heat. Most fires that originate under the hood (engine fires) are caused by a malfunction of the gas line connectors, along the drive line, or in wheel areas. In newer cars, fires originate from gas leaks at short sections of the neoprene hoses in the fuel lines; power steering fluid; transmission fluid; brake fluid; coolant fluids used as freon substitutes and friction from brake linings.

The greatest hazard in a car fire is from chemical exposure rather than combustion. The newer the vehicle the greater the hazard due to increased use of plastics and synthetic materials. The vehicle interior is full of materials that release toxic byproducts when burned. Toxic smoke is released from plastic trim, foam padding in seats, synthetic fabrics, carpets and wiring insulation. On the exterior, new generation fiberglass or plastic body panels decompose and release more chemical hazards. Prior to the use of plastics it was impossible to burn a vehicle completely. The amount of plastics and hydrocarbon fuels in a modern car can easily exceed the fire load of a room and contents fire. As a consequence, vehicles burn so fast and intensely that they are often over by the time firefighters arrive. Such fires present a greater danger today than ever because of new material and design changes. For example, the need for pollution control lead to sealed fuel systems and high pressure injectors which has increased explosion hazards, while the increased use of magnesium in steering columns and structural components for weight reduction has made it more



Heat, Flame and Smoke Detection for Tunnels

difficult to extinguish these types of fires because magnesium burns hotter and faster as water is applied and turns the water into steam while the water splatters molten metal around.

Synthetics comprise a huge fuel load in the modern automobile. The synthetics content can be as much as 30% of the vehicle weight. This includes plastics, paints, lacquers, varnishes, almost all interior surfaces, and outside surfaces including bumpers, shock absorbers, and trim. When burned, most of these synthetic materials degrade into a host of toxic chemicals.

DETECTABLE ATTRIBUTES OF VEHICLE FIRES

There are several different physical and chemical phenomena of fire that can be detected. Those include combustion byproducts, smoke, radiation, and heat. The following will illustrate the advantages and drawbacks of each in order to make the best tradeoffs and select the most appropriate technology for use in a tunnel detection system.

COMBUSTION BYPRODUCTS

These are gasses and substances released as materials in the vehicle are oxidized when they burn. These combustion gasses may be released for some time during the first stage of the fire well before smoke becomes evident. They will be present in the exhaust air duct before smoke becomes noticeable on CCTV. There are many types of gasses that could be sensed and sensing technologies that can measure trace amounts in the parts per billion (ppb) or parts per trillion (ppt) are needed for this concept to be viable and provide the earliest possible warning. The sensing technologies with appropriate capabilities for chemical sensing such as Non-Dispersive Infrared (NDIR); Fourier-Transform Infrared Spectroscopy (FTIR); and other solid state chemical sensing technologies are available and should be further developed to allow practical applicability.

Possible drawbacks to be considered are that some of these technologies are subject to cross sensitivities whereby another gas may react with the sensor so it may seem like the target combustion is present when in fact it is not. Chemical sensing technologies require careful design as a possible application in a tunnel environment.

Pic: courtesy of Protectowire

SMOKE

Smoke consists of particulates as well as the gasses discussed above. The particulate matter is mostly carbon based by-products of the combustion and bits of unburned material. Smoke will seep out of small gaps even if the fire is mostly contained. A fire contained in the trunk, passenger compartment with windows up, or under the hood of a moving vehicle can be much more severe than the smoke wisping out would indicate. Smoke may be present during the smoldering phase long before flame is evident and becomes the primary hazard to motorists in a tunnel.

Several technologies are available for sensing smoke including detectors based on ionization and electrostatic phenomena as well as photoelectric opacity sensing and emissivity measurement, infrared technology and incipient smoke detection by air sampling techniques. All of these devices for sensing smoke can be vulnerable to false alarms from vehicle fumes, salt, dirt, dust and tunnel washings. The tradeoff between low sensitivity for earliest detection and higher sensitivity to reduce false alarms is the key consideration. Smoke detection also does not precisely locate the fire.

RADIATION (FLAME)

The characteristic of radiation from a flame can be sensed before significant heat is released. The specific wavelengths of radiation released depends on the specific substances undergoing oxidation though the fire spectrum will generally be in the same band. This

Tai Lam Tunnel *Pic: courtesy of Eternet Asia*

becomes a consideration when trying to separate combustion from other IR radiation sources in the tunnel such as exhaust plume, frictionally heated parts, and engine heat. This radiation occurs in the infrared (IR), visible (VIS), and ultraviolet (UV) bands. The primary sensing technologies of interest are those for measuring UV and IR radiation. False alarms may be generated by some of the other IR sources mentioned above though that may not be a problem for a detector that analyzes the spectrum rather than making the detection based on a single broad band measurement. Smoke obscures the shorter wavelengths "Near" IR, visible and UV. Longer wavelengths have better penetration so the IR will have a greater range than the UV in the same smoke. UV is also blocked by glass. The hood, trunk and roof of the vehicle are opaque to these sensors until they are heated to the thousand plus degree temperatures of the fire. This may or may not occur before heat can be sensed thermally. The drawback for considering flame detectors in a tunnel environment is the constant maintenance required to keep optical lens clean of fumes, dust, and tunnel washing droplets that dry on the lens.[2]

HEAT

Heat is usually the last sign of the fire that is detectable under normal vehicle fire conditions. The heat must be conducted or convected by the air in the tunnel to the sensor. The heat can be detected if the fire either breaches the compartment, spreads to external components like tyres, or heats the roof, hood or trunk to a sufficiently high temperature. After chemical exposure, heat is the next greatest danger to vehicle occupants, nearby motorists, and response personnel. Situations where fuel spills and instantaneous ignition develops will generate extremely high energy release rates where heat detectors will activate long before chemical or smoke detection would be possible. While heat detectors may appear to be more vulnerable to false alarms because they are sensitive to lower temperatures than devices for detecting flame, by proper selection and adjustment of alarm temperatures, they can operate in environments

Pic: courtesy of Protectowire

where exhaust plumes from trucks and hot air pools at the tunnel ceiling can be overcome.

Heat detectors generally are used where other types of detector would be unsuitable in aggressive environments. While heat detectors may appear to be the slowest method of detecting the by-products of fire, they still remain the most reliable detection device used in tunnels in view of their reliability, robust construction, low maintenance, and proven response times. Heat detectors are available with a variety of operating principles and classified as either area type (rate compensated, rate-of-rise, spot) or linear type (thermoresistive, thermistor, fiber optic, pneumatic). Linear type heat detectors are normally used in tunnels because long monitoring lengths are possible in a single detection zone rather than installing hundreds of area detectors along the tunnel length.[3]

It is important to control traffic as soon as possible, reduce the threat to motorists, and aid responders to reach the fire. Even more important than traffic control is to activate the response as soon as possible. The longer a vehicle burns, the greater the life safety danger to motorists and fire fighters. This is the role of the fire detection system.

ACKNOWLEDGEMENTS

1. Federal Highway Administration, Prevention and Control of Highway Tunnel Fires. Publication #FHWA-RD-83-032
2. Vehicle Fire Sensing for CA/T,M.I.T. Intelligent Transportation Systems report, 1994.
3. Eppich, International Fire Protection magazine, Issue 3, Aug 2000, "Fire Detection Systems in Road Tunnels."

Bill Eppich is Manager of Special Hazards Engineering for The Protectowire Company in Boston. He serves on the Technical Committees for NFPA 513, *Motor Freight Terminals;* NFPA 520 *Subterranean Spaces*, and is Secretary of NFPA 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways.*

LIFE AFTER HALON?

Angela Richards
of Loss Prevention Certification Board

Pic: courtesy of LPCB

BACKGROUND

HALON is an effective, tried and tested extinguishing agent and is a favourite with fire protection professionals, particularly for computer rooms and other high risk areas. Halon puts the fire out quickly, with minimum disruption, and therefore any interruption to the business is greatly reduced.

However, under the Montreal Protocol* the *use* of Halon is banned from 31st December 2002 and all systems must be *totally decommissioned* by 31st December 2003.

REGULATION EC2037/2000

This regulation permits the recycling and recovery of Halon for use in servicing 'critical' fire protection systems. Annex VII lists the critical uses as:

- Aircraft and military use
- Gas and petrochemical sectors
- Ships carrying flammable liquid or gas
- Channel Tunnel

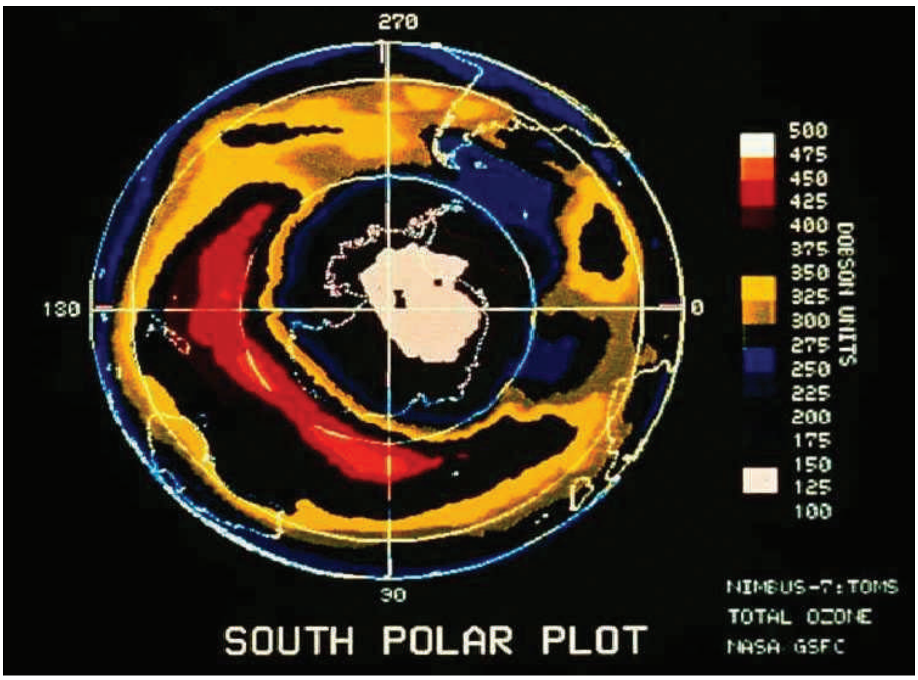
The European Commission will review the list yearly and may remove an item should an alternative become available.

So unless the business falls into one of the above categories, it is imperative that the building owner or occupier urgently reviews this problem of firstly how to remove any Halon system and secondly how to replace it.

SUITABLE ALTERNATIVES?

The Association of British Insurers (ABI) commissioned LPC to carry out a research project to identify Halon alternatives. The findings formed the basis of the development of European and international standards and the report entitled Halon Alternatives can be purchased via the Fire Protection Association. The following alternatives were researched:

- **Halocarbons:** Chemical agents containing chlorine, fluorine or iodine which act mainly by heat absorption.



Ozone layers

Pic: courtesy of LPCB

Pic: courtesy of LPCB

These include HCFCs, HFCs, fluoroiodocarbons (FICs) and perfluorocarbons (PFCs).

- **Inert gases:** Contain reactive gases that reduce the ambient oxygen concentration in a protected space to between 10-14%, a level which is breathable but will not support flaming combustion. These include argon and nitrogen.
- **Powdered aerosols:** Pyrotechnically generated aerosols and dry chemical/halocarbon agents
- **Traditional:** Dry chemical, carbon dioxide, water sprinklers and foams
- **Water mist:** Tiny droplets released under low, medium or high pressure.

There is no single solution and before making a decision, consideration must be given to carrying out a new risk assessment. The Halon system was probably installed many years ago and since the Montreal Protocol was agreed back in 1987, the science of fire engineering has grown considerably and so has the number and variety of active and passive fire protection products available on the market. An important factor to consider is the potential business interruption during the replacement process. Another factor is the major financial consideration if total replacement of equipment components is deemed necessary. Will the proposed extinguishing agent put out the fire? If it is released either in a fire scenario or accidentally, will there be any by-products? If the proposal includes the re-use of existing component equipment, is this equipment suitable for the proposed agent? Are the appropriate venting arrangements in place? These are just some of the problems that face the decision maker.

LPS 1230

To help specifiers select the right product, the LPCB has recently developed a standard entitled LPS 1230 Fire test specification and performance requirements for LPCB approval of fixed gas fire extinguishing systems. This standard looks at the ability of the system as a whole to extinguish the fire and provides confidence to the specifier that a fixed fire fighting system will successfully cover the risk.

LPG Tecnicas en Extincion de Incendios S.A. (Spain) are the first company to gain LPCB approval to LPS 1230 for their LPG FE-13 Fixed Fire Fighting System which is a halocarbon. Wormald Ansul (UK) Ltd have also recently gained approval for their Inergen system which is an inert gas.

Pic: courtesy of LPCB

INSTALLATION

No matter how good a fire product may be, its effectiveness can be severely undermined by poor installation and a sister standard entitled LPS 1204 Requirements for firms engaged in the design, installation and commissioning of fire fighting systems provides assurance that the system has been designed and installed correctly.

Both LPS 1230 and LPS 1204 are available to download free of charge from our website. We also offer approvals of Gaseous System Components to the EN12094 series.

CONCLUSION

As stated at the beginning of this article, the ban comes into effect at the end of this year. There is so little time to seek good independent advice and to select the appropriate system for you and to choose an approved installer. **YOU MUST ACT NOW!**

To find out which systems, components and installers are approved by LPCB, please check out our website www.redbooklive.com or telephone our helpdesk on 01923 664100 for further information.

*The Montreal Protocol states that the use and possible release of greenhouse gases must be reduced significantly in an attempt to reduce the size of the hole in the ozone layer. The European Commission has published EC2037/00 which bans the sale and use of ozone depleting substances such as chlorofluorocarbons (CFCs), halons, carbon tetrachloride hydrobromofluorocarbons and 1,1,1-trichlorethane

The Total Solution

LPG TÉCNICAS EN EXTINCIÓN DE INCENDIOS, S.A.

ARGON (IG-01) 200&300 bar

THE NATURAL EXTINGUISHANT

LPCB & VdS APPROVED

WATER MIST

EXTINGUISHING USING THE STRENGTH OF WATER

HALON REPLACEMENT

The Demand to replace is now firmly set into the diary.
After December 2002 if discharged, Halon 1301 cannot be refilled.
After December 2003, Halon 1301 will be a banned substance.

The costs for removal and legitimate disposal are increasing as Halon removal increases, don't wait until its too late! Contact us now.

Protecting Life and Property while respecting the environment

Enquiries: marketing@lpg.es

FE-13 ™

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Certified company: ISO9001 ISO9002 Products certified by: LPCB VdS CNPP

NIGEL STOCKWELL explains some of the design criteria of the new Vantage spatial sounder range and how this new product completes a modern range of 24 volt electronic sounders available from an Independent Manufacturer.

Over the last few years, market perception of what was previously considered a specialist product has changed to that of being a commodity. This is particularly reflected in higher volume items of field equipment such as conventional smoke detectors and electronic sounders.

Increasingly, manufacturing of such products has polarised to organisations that are themselves part of a larger group of Companies, frequently with the ultimate beneficiaries based overseas.

As an independent company, Cranford Controls Ltd has pursued a route of investment into research and development, together with increasing and improving manufacturing resource.

The new Vantage range of spatial sounders has been built on the sum of these experiences and by asking our Customers and installers what features and benefits would benefit them. Vantage therefore completes a modern and effective range of sounder products that may be sourced directly from a **Loss Prevention Certification Board (LPCB)** approved manufacturing facility.

Vantage joins the Vector and Vara sounders as the mainstream conventional sounder products at Cranford. It takes over from the Viper sounder as Cranford's spatial sounder.

There are several key benefits:

- Vantage gives a new high output 105 dBA as standard. This means that customers can select, via the dil switch, the appropriate volume setting (low, medium and high) together with the required tone. Vantage has four standard tones for the UK market, with alternative tones available for other countries. All Vantage sounders are delivered with the volume set to a nominal 101 dBa output, and the tone set to sweep (see table).
- New small folded horn design gives improved lateral sound dispersion, coupled with significantly reduced overall dimensions. The folded horn design also makes it look like what it truly is: a fire alarm sounder!
- Shallow mounting base with an easy access way through into the main sounder body, thus reducing installation time. We believe Cranford is the only mainstream sounder manufacturer to offer an "open" style of shallow sounder mounting base.
- A new versatile deep mounting base for IP65 applications. With an easily removed cover plate, this deep mounting base uniquely gives the choice for wiring from the ceiling (cover plate removed) or directly into the rear of the mounting base (cover plate left in place). Installers need stock only one base type for both occasions, discarding the cover if required.
- Vantage is cost effective compared with its rivals

The New Vantage Range: Provisional Specification

Par No	Description	Tones*	Max Sound Output @ 24 Vdc	Current @24 volt Max output	Standard Output @ 24 Vdc	Current at 24 Vdc (standard output)
VTG-SA6-SB-R	Vantage Sounder c/w shallow base	4	105	<28 mA	101 dBa	<13 mA
VTG-SA6-DB	Vantage Sounder c/w Deep base	4	105	<28 mA	101 dBa	<13 mA
VTB-SA6-SB	Vantage Combi Combined Audio-Visual sounder-shallow base	4	105	<40 mA	101 dBa	<25 Ma
VTB-SA6-DB	Vantage Combi Combined Audio-Visual sounder-deep base	4	105	<40 mA	101 dBa	<25 mA

**all tones compatible with Vector, Vara and Viper sounders*

Combination Sounder/Flasher

Essential to any new range of sounders is to have a combination unit, capable of giving a good sound and light output.

The new Vantage-Combi utilises new, high brightness led's, giving excellent light output that remains "on" for a greater period than a conventional xenon flash tube. The use of led's also means that the higher currents associated with xenon's are now reduced, making the new Vantage-Combi an extremely energy efficient product. All flash outputs are also synchronized

Design Criteria

In the design phase of the Vantage sounder range, the use of a potting compound was carefully considered. This technique has the benefit of securing all components internally and offering a shield to the outside world.

There are several disadvantages. More complex pc boards can be prone to problems during the curing process. Additional concerns were scrap costs, which are inevitably higher, and long term pricing of encapsulation compounds.

For the mechanical protection of the drive circuit, the new Vantage has a protective cover plate. Underneath the plate lies the large area of "real estate" that may be used for the printed circuit boards allocated to VOCALARM and other Customer related products in the future.

The new Vantage range of sounders will be available from August.

The Vantage range is manufactured by

CRANFORD CONTROLS LTD

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E-Mail : sales@cranford-ltd.com
Web : www.cranford-ltd.com

ALARM PANEL ROUND-UP

SAFE & EASY CONVENTIONAL FIRE PANELS

Alarmcom is pleased to launch its new conventional panel series the FC500C. The range consists of 2, 4, 8 and 12 zone versions all coming with a wealth of features to ensure compliance with the toughest of specifications.

In common with Alarmcom's renowned 'safe & easy' philosophy the range is simplicity itself to install and use and offers a quality of build that is second to none.

The FC500C is fully compliant with EN54 parts 2 and 4 and can provide capacity for up to 72hrs of integral standby.

The system has the ability to operate in manned and unmanned mode which allows signalling to the fire brigade to be delayed in the event of operation of an automatic detector while signalling immediately if a manual call point or further detection zone is activated. Manual call points can be mixed on a zone with automatic detectors and still provide manned/unmanned differentiation.

Outputs are provided for fire, stage 1 and 2 alarm, fault and disable as well as individual outputs for each zone. Additional inputs are available for remote evacuation, acknowledge, reset, access, manned/unmanned switching and remote transmission disable. Numerous programmable features complete the ranges ability to match most requirements.

For more information please contact:
Alarmcom AG
Tel: +41 1 922 61 55
Fax: +41 1 922 64 80
www.alarmcom.com

C-TEC GET LPCB APPROVAL

C-TEC's CFP conventional fire panel has been tested and approved as meeting EN54 Parts 2 and 4 by the Loss Prevention Certification Board (LPCB)

To achieve this accreditation the panel was submitted to extensive testing by the Loss Prevention Council to verify it met all of the relevant EN54 clauses concerning functionality and performance.

The successful conclusion of these tests has resulted in three LPCB approved fire panels being added to C-TEC's portfolio – a two, a four and an eight zone version. All three are now available ex-stock with the following user and installer friendly features:

- Class Change and Alert inputs
- Auxiliary fault, reset, remote and auxiliary outputs
- Four conventional sounder circuits
- Programmable delay, zone test and comprehensive fault diagnostic features
- Push button access code entry to access levels 2 and 3
- An attractive flush or surface mountable plastic lid and enclosure

For over 150 years, the LPCB and it's predecessor, the FOC (Fire Officer's Council), have been working with suppliers, specifiers, regulators and insurers to set the standards necessary to ensure that fire and security products are fit for their intended purpose. In addition to the successful accreditation of C-TEC's CFP fire panel, the company's ISO9001 quality accreditation system has been accredited by the LPCB since 1994.

For more information please contact:
C-TEC
Tel: + 44 (0)1942 322744
Fax: + 44(0)1942 829867
E-Mail: sales@c-tec.co.uk

EDWARDS INTERNATIONAL – NEW FIRE ALARM CONTROL PANELS OFFER THE BEST OF BOTH WORLDS

A new line of fire alarm control panels from **Edwards Systems Technology, Inc.** (EST) liberates small and medium-sized buildings from the all-or-nothing approach to system design. QuickStart life safety systems support intelligent circuits, conventional circuits – and a combination of both.

QuickStart lives up to its name in every respect. Its exclusive auto-learn routine, combined with its built-in scanner port ensures a fast, trouble-free installation every time.

New installations benefit from EST's widely acclaimed Signature Series family of intelligent detectors and modules. Now no job is too small for true multisensor technology, environmental compensation, electronic addressing, and the power of intelligent processing that, before QuickStart, was the exclusive domain of big systems.

Retrofit applications enjoy the best of both worlds. QuickStart's support for both intelligent and conventional circuits ideally positions this innovative control panel for upgrading an existing system all at once – or in stages. With Signature Series' unique ability to use existing wiring, expensive communications-grade cable and costly rewiring is not required in most retrofit situations. This means every retrofit can enjoy the benefits of a major system upgrade without the cost or disruption to building activities normally associated with a life safety overhaul.

New or retrofit, QuickStart's application flexibility and ease of operation make it an ideal choice for schools, apartment building, hospitals, office building and retail facilities. Easy to install, simple to set up, and rock-solid when it comes to performance, QuickStart control panels are an installer's dream and a building owner's delight.

For more information please contact:
EST
Tel : +1 905 270 1711
Fax : +1 905 270 9553
www.estinternational.com

NEW FIRE ALARM CONTROL PANEL FROM FIKE

BLUE SPRINGS, MISSOURI – Fike Corporation is pleased to announce the introduction of the Shark analog, addressable fire alarm control panel. The Shark brings Fike's reputation and experience of building high quality suppression panels to the fire alarm market. By using the latest in technology and manufacturing techniques, the Shark system is feature rich, cost effective and backed up with the same reliability built into all Fike control panels.

The Shark control panel is a single loop analog addressable fire alarm system which can be expanded to two loops. Each loop supports up to 99 detectors and 99 modules, giving a system maximum of 396 devices. It comes with 6 amps of usable power in either a 120 VAC or 240 VAC primary. The Shark is also feature rich. In addition to being an analog addressable system, it comes standard with features such as drift compensation to automatically compensate for dust buildup in detectors, pre-action/deluge sprinkler control, drill function, PAS (positive alarm sequence) pre-signal per NFPA 72, auto-program to decrease installation time, walktest . . . and much more!

The Shark is configured with SharkTooth, an easy to use configuration program. SharkTooth uses the same principle and "tree" style menu structure as Windows Explorer®, therefore, navigating and configuring with SharkTooth is very similar to navigating through folders using Windows®.

For more information please contact:
Fike Corporation
Tel : +1 816-229-3405,
Fax : +1 816 229 4615
E-mail : fpssales@fike.com,
Web : www.fike.com.

KIDDE FIRE PROTECTION – APPROVED TO THE HIGHEST STANDARDS

VEGA FIRE CONTROL PANEL FROM KIDDE FIRE PROTECTION

Since its introduction, the phased development program for the Kidde Vega Analogue Fire Alarm Control Panel, has delivered a comprehensive set of features and benefits to the Fire Systems professional.

Underlining our commitment to continuous product improvement and development, Kidde Fire Protection can announce the Vega Fire Control Panel has successfully achieved approval and certification by the Loss Prevention Certification Board to BS EN54 parts 2 & 4.

Available from 1 detection loop up to 16 loops with 24, 56, 88 or 120 zone indicators, Vega is extremely flexible for small medium and large applications ranging from small office and commercial buildings to large complex industrial sites, hospitals or educational establishments.

The Kidde Vega supports Apollo XP95, Discovery and Hochiki ESP detector protocols offering the specifier and installer a comprehensive choice for new system configurations, refurbishments and system extensions.

The Vega's capacity and flexibility can be further extended using one of the networking options available. Simple common zone Peer-to-Peer networks for high rise buildings and smaller system layouts or Central Supervisory networks complete with PC graphics or text for larger geographical spread systems up to 32 Vega panels.

Maintaining the principle design concepts of modularity, flexibility and quality, Vega is approved to the highest standards and continues to provide outstanding performance at a competitive price.

For more information please contact:
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Web Site: www.kfp.co.uk

MORLEY-IAS FIRE SYSTEMS

Morley-IAS designs and manufactures fire alarm control equipment, which can accept a range of standard detector protocols from such specialist suppliers as Apollo, Hochiki, Nittan and System Sensor. The fire alarm control panels themselves are microprocessor based and embody both software and hardware that has been researched and developed by Morley-IAS.

Our Firestar range of control panels is designed for smaller installations and utilises conventional detection devices. Available in 1,2,4 or 8 zone versions and designed to meet the requirements of BS5839. Larger premises are easily protected using our analogue addressable range of control products. The ZX Series offers intelligence, flexibility, modularity and networking allowing exact configuration of systems to customer requirements. All or our analogue addressable control panels combine "Autolearn", recording of events, diagnostics, dedicated commissioning and user menus and the ability to programme all features from the front of the panel or via the dedicated PC configuration tool. Simple scaleable networking allows systems to be installed and upgraded to a maximum of 99 panels of 5 loops or potentially over 60,000 devices. A solution for all installations from small industrial or commercial units to large multi-site office complexes, industrial plants or shopping malls.

All Morley-IAS products are manufactured to the demanding quality standards of ISO 9001, and carry approvals by UL or LPC and are designed to meet the stringent requirements of EN 54.

For more information please contact:
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The **NOTIFIER VIEW**™ sensor provides a revolutionary advance in early warning smoke detection technology. The unique design of this sensor, combined with enhanced AWACS & DIG algorithms in the NOTIFIER ID60 series intelligent fire alarm panels, allow smoke detection sensitivity that is 10 to 50 times higher than present photoelectric technology, yet provides a system that is easy to maintain, adaptable and 100% addressable.

(DIG) Dynamic Intelligent Grouping allows the ID60 series to combine the analogue values from up to 99 VIEW™ sensors to provide co-operation between them. The ID60 can then make pre-alarm and alarm decisions based on more than one sensor thus increasing sensitivity whilst maintaining false alarm immunity.

Using the enhanced patented AWACS & DIG algorithms, the ID60 series provides Drift Compensation, Maintenance Alert, Sensitivity Adjustment, Self-Optimizing Pre-Alarm, Dynamic Intelligent Grouping, Lint Trap and Reference Detecting.

The ID60 is the entry-level unit, housed in a compact enclosure and providing an easy to install and maintain system. The ID61 includes an optional internally mounted printer and a larger power supply for applications where a large number of loop-powered sounders are required and the ID62 has the additional benefit of 72hr stand-by battery back-up to ensure coverage continues if the mains power supply is interrupted for a long period. All versions support up to 99 smoke, thermal and multi-criteria detectors, plus 99 addressable sounders, call points, control modules and monitor modules on the same loop, managed from the panel.

For more information Please contact:
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Fax : +44 (0) 1444 230 888
E-Mail : sales@notifier.ltd.uk
Web : www.notifier.ltd.uk

SIEMENS LIFE SAFETY INTRODUCES INTELLIGENT FIRE DETECTION LIFE SAFETY SYSTEM WITH LARGE INTERFACE SCREEN

Siemens Fire Safety, a division of Siemens Building Technologies, Inc, has introduced an intelligent fire detector system which brings an impressive amount of fire and building related information to fire fighters. The new system delivers more of the information fire officials require to locate and fight a fire. The 6″ interface screen is the largest in the industry, conveying more of the information the fire community has expressed a need to see.

Siemens **FireFinder** offers an operator interface screen, which communicates in hundreds of easy-to-read, large-text characters eliminating the need to abbreviate, displaying up to five events simultaneously using standard hazmat icons for safety. It employs shading to highlight critical information and two type sizes for emphasis, with further information easily accessed via a lighted "More Info" button. Simple graphic maps are incorporated for clarity. Also available are standard NFPA fire safety symbols to provide information about the type of fire service equipment available in the alarm area.

The **FireFinder** system provides easily recognizable "standard" symbols to indicate two main pieces of information: 1) "Fire Service Equipment" in the area of the alarm – showing sprinkler standpipe connection points, gas valve shut offs, electrical panels. 2) "Area Contain" this is a second set of symbols/icons unique to the area of the fire alarm being reported that advises the responder using universally recognized NFPA 170 symbols what to expect: e.g. handicapped personnel, hazardous materials, if the area contains an exit, explosive materials, bio-hazardous materials, etc.

For more information please contact:
Siemens Building Technologies
Tel : +1 973-593-2600
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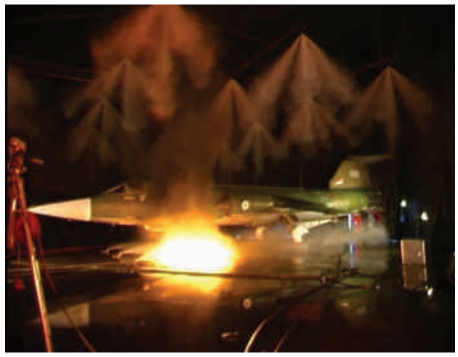
www.cerbpyro.com

New IWMA Board will serve for three year term

The IWMA annual member meeting took place on April 12, 2002, in conjunction with the 2nd International Water Mist Conference. About 80 fire safety experts participated in the symposium. The delegates, who came from 19 countries, discussed newest scientific findings, new applications for water mist technology as well as the current situation concerning guidelines. The conference proceedings will be sent out to all delegates in August. Interested parties who had no possibility to attend the meeting personally, can order a copy by contacting the IWMA office (please see contact information below).

As part of the member meeting, the members present have, besides the review of the last business year, elected a new IWMA board which will serve for the next three year term. The new members of the board are (alphabetical order) Chris Dubay, National Fire Protection Association, USA, David LeBlanc, Tyco R & D, USA, Jack Mawhinney, Hughes Associates, USA (Vice Chair), Petteri Saarinen, Marioff Corporation Oy, Finland, Dirk Sprakel, Fogtec Fire Protection, Germany, Robert T. Wickham, Wickham Associates, USA, and Ragnar Wighus, SINTEF, Norway (Chair).



A spectacular test series to demonstrate an application of water mist in the protection of aircraft in hangars. This test was conducted by the Norwegian Fire Research Laboratory (SINTEF) in 2001. In the large test hall shown, tests showed that locally applied water mist protected the aircraft from damage when it was released within 10 seconds of ignition. The typical result was the water mist limited the damage at the level before application. Water mist installations can save a lot of investment in water supply to large hangars. *(Photos courtesy: SINTEF)*

Forthcoming Events

3rd International Water Mist Conference in Barcelona from 9–11 April 2003

The 3rd International Water Mist Conference, being organized by the International Water Mist Association, will be held from April 9-11, 2003. After this year's annual conference in Amsterdam, The Netherlands, the venue for the 2003 symposium is going to be Barcelona, Spain. Interested parties should browse the association's web page (www.iwma.net) which offers all necessary information regarding this upcoming symposium.

The outline of the 3rd IWMA conference will differ from previous symposiums, for the focus of the conference is going to be much more on applications and actual solutions. Particularly subject matters as safety for mass transportation systems, traffic tunnels, office buildings, hotels and galleries, industry facilities as well as halon and sprinkler replacements in general will be addressed. As a cross section, different viewpoints of various topics will be discussed. Hence, the conference offers an excellent opportunity for end users, customers and governmental representatives to extend their knowledge concerning this efficient fire-fighting technology. Attendees of the 3rd International Water Mist Conference who would like to present a paper may submit an abstract of the paper no later than 14 February 2003. The conference may be sponsored by interested organizations. Interested companies should contact the IWMA office for detailed information on sponsorship possibilities. The IWMA annual member meeting 2003 will take place during the conference week in Barcelona as well.

Audience at the Amsterdam conference in April. *(Photo courtesy: IWMA)*

Workshop in Mobile, USA, from February 25-27, 2003

Additionally, the IWMA will co-sponsor a workshop on water mist fire suppression which will take place from February 25-27, 2003, in Mobile, USA. This workshop will also provide government and industry representatives with state-of-the-art presentations on water mist fire suppression technology, such as suppression mechanisms, drop size and momentum characteristics, requirements, standards and specifications as well as advantages and disadvantages of low, medium and high pressure systems. The deadline for abstract submission is September 15, 2002.

Educational Seminar on May 16, 2003

The International Water Mist Association and the National Fire Protection Association (USA) are going to conduct an educational seminar in co-operation in 2003. This seminar is planned for May 16, 2003. The seminar is outlined for fire protection and consulting engineers, property managers of industry facilities, field engineers if AHJs and other interested parties who need some technical exposure. Certain issues will be addressed like, for example, how to design pump systems, how to write specifications as well as general background information, such as the understanding of standards.

Contact

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www.iwma.net, contact@iwma.net

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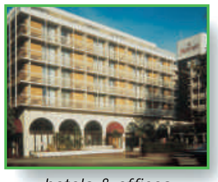
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Water-Mist Research Pays Dividends

By Factory Mutual Insurance Company

At FM Global Research, this applied research in water-mist fire protection systems helps ensure adequate fire protection and minimize risk for commercial and industrial properties and also benefits manufacturers and the overall fire protection industry.

What follows are summaries of three recent applied research projects designed to quickly evaluate water-mist fire protection systems, fire protection options and to recommend effective and practical solutions.

New cutting-edge research projects are leading the way in the advancement of water-mist fire protection systems, including the evaluation and approval of water-mist systems for a growing range of applications.

PRESCRIPTION FOR FIRE PROTECTION

When a large pharmaceutical company decided to construct a new multiscience facility, fire protection and nonthermal contamination control were key concerns. The plan was to outfit the new facility with up to 200 chemical fume hoods, each measuring 8ft (2.5m) wide and 8.5ft (2.6m) high, for use in drug research.

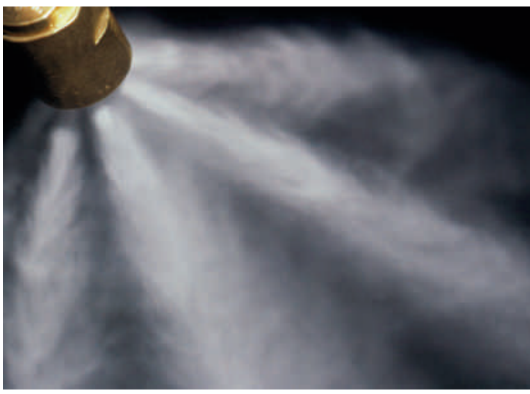
The original fire protection plan for the fume hoods called for a single automatic sidewall sprinkler. The company wanted to confirm whether a single, conventional sprinkler would be sufficient to control a flammable-liquid fire in the hood fast enough to prevent thermal and nonthermal damage. Sufficient quantities of smoke can severely damage test samples or sensitive electronic equipment used in the research facility, possibly resulting in disruption to major research projects.

Along with the concern that a conventional sidewall sprinkler alone might not control a hood fire quickly enough, there also was a risk that the quantity and velocity of water released by the sprinkler would actually force fire gases and water – carrying solvent runoff – out of the hood.

FM Global Research and the pharmaceutical company jointly planned a series of experiments to test both the proposed fire protection design and several alternatives, including water-mist systems. Testing was conducted at FM Global Research's laboratories in Norwood, Mass., USA, using one of the actual fume hoods that would be used in the customer's research facility. Hexane fuel was used in the experiments. Two types of sprinkler heads were tested – a sidewall and a pendant style; and two water-mist nozzles – a deluge style and a thermal-link model.

A total of 24 tests were conducted, including pan fires and full-scale bench-top spill tests. The overall objectives of the experiments were to determine:

- the maximum fire load that would not exceed the exhaust capacity of the hood;
- whether a sidewall or a pendant sprinkler in the hood would extinguish or control the maximum fire load without propelling a significant amount of fire gases from the hood, and also prevent involvement of other solvent bottles in the hood; and
- whether water-mist nozzles provide more effective fire protection than sidewall or pendant sprinklers in this application.



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"We needed to provide our recommendation in about two months in order to meet their construction schedule," Bert Yu, Research project leader, explained. "The hood maker had to know how to configure fire protection for the hoods – and they had a firm deadline to meet. While there were similarities between the fume hoods and wet-bench environments, there also were many differences that required us to conduct a specific investigation for the application of water-mist fire protection."

The series of experiments showed that, not only did the thermal-link, water-mist nozzle react more quickly – nine seconds versus 25 for the sidewall sprinkler – but it also prevented breakage of the gallon (3.8 L) bottle in the hood. This breakage prevention was attributed to the natural cooling effect of water mist. In addition, because of its lower discharge rate of 6-7 gpm (23-27 Lpm) versus 25 gpm (95 Lpm) for the sidewall sprinkler, the water-mist nozzle forced far less hexane, fire and gases out of the hood upon activation. Because the thermal-link water-mist system met the protection requirements, the option of adding deluge water-mist protection, equipped with more sensitive, but more costly, fire-detection sensors (e.g., UV/IR detectors), inside the hood was deemed unnecessary.

Based on FM Global Research results, it was recommended each hood at the customer's new research facility be equipped with two water-mist nozzles. The initial plan to use an automatic sidewall sprinkler was eliminated in favor of the water-mist nozzles equipped with thermal-bulb triggers rated at 155°F (68°C). In addition, these nozzles also were equipped with extra guards to prevent accidental discharge. This design change resulted in better protection for the customer.

According to Yu, the water-mist installation guidelines for the fume hoods, developed by FM Global Research, is referenced in the National Fire Protection Association (NFPA) standard 45 Annex, Standard on Fire Protection for Laboratories Using Chemicals.

HIGH-PERFORMANCE FIRE PROTECTION

At a construction cost of approximately US$1 million per engine test cell, and with 36 cells to be built in the initial development phase, the BMW Group had a lot riding on its new research facility outside Munich, Germany. Fire protection for the heavily instrumented engine test cells was a key concern. With fuels and lubricants flowing

through hoses to the engines at high pressure, spray and pool fires were a significant risk.

FM Global engineers reviewed the proposed fire protection plan for the engine test cells last spring and grew concerned that powerful ventilation and large obstructions within the cells would impede the water-mist protection system. The fire protection challenge was further complicated by a large sub-floor space housing ventilation ductwork and mechanical equipment, which had the potential to trap leaking or spilled fluids from the test cells located above the sub-floor.

To evaluate the proposed water-mist system, a full-scale mock-up of the engine test cell was built at the FM Global Technology Center in West Glocester, R.I., USA. Working under a tight deadline, a research team developed a test program to determine whether potential fires in the proposed engine test cell could be extinguished or controlled by the proposed water-mist system.

The engine test cell mock-up included a large steel box placed in the center of the cell floor to simulate the largest engine that would be tested in the BMW Group laboratory, as well as two instrumentation cabinet mock-ups suspended from the cell ceiling. In addition, a large array of air ducts, used to simulate engine ventilation at cruising speeds, was installed at one end of the test cell mock-up.

The proposed water-mist design specified that nozzles, equipped with glass bulb thermal-link triggers, should be located on the cell ceiling and inside the engine ventilation ducts. Diesel and room temperature n-heptane were used to simulate heated lubrication oil and gasoline, respectively.

More than two dozen tests were conducted to evaluate the effectiveness of several combinations of water-mist nozzles on various types of pool, spray and combined pool and spray fires.

Two types of detection/trigger mechanisms also were tested – UV/IR detectors and glass-bulb links. Through this evaluation, it was determined that the original layout of nozzles, located only at the ceiling and in the engine ventilation ducts, could not extinguish a 40-in^2 (1-m^2) n-heptane pool fire, partially shielded below the engine mock-up or located below the ceiling ventilation opening. (Note: Pool fires with n-heptane and diesel located in other areas of the test cell could be extinguished with the original layout of nozzles.)

To provide adequate protection, two additional water-mist deluge nozzles were added to the sidewalls of the engine test cell, and linked to two

FM Global engineers grew concerned that powerful ventilation and large obstructions within the cells would impede the water-mist protection system

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UV/IR detectors located diagonally apart in the upper ceiling corners. Two additional ceiling nozzles also were added to address certain vulnerable areas. The original glass-bulb link nozzles located in the sub-floor area were tested and found to provide adequate protection without modification. Since the completion of this research last summer, the BMW Group has built 36 engine test cells at its new Munich research facility, using the FM Global Research-recommended water-mist protection system.

FIRE PROTECTION IS PRESSING MATTER

When a European manufacturer of medium-density fiberboard (MDF) needed fire protection for its continuous-board presses, it turned to a water-mist system from Minimax GmbH in Germany. An FM Global team traveled to Germany to verify that the proposed water-mist system could adequately protect the 30 planned board presses, each valued at US$30 million.

> *The team's goals were to verify that a water-mist system could control or extinguish spray and pool fires in the press pockets*

MDF is used extensively in manufacturing furniture, flooring, paneling and moldings. MDF and other wood-composite panels are typically produced by mixing wood particles and chips with resin and other additives. This mixture is fed into a continuous press where it is compressed and heated until it reaches its finished dimension.

Continuous-board presses are large systems that move the wood-and-glue mixture along heated stainless steel belts. These presses can measure more than 15-ft. (4.5-m) wide, 15-ft. (4.5-m) high, and 165-ft. (50-m) long. A series of hydraulic pistons apply tons of pressure to steel platens, which ride directly above and below the stainless steel conveyor belts and are heated by means of circulating thermal fluid.

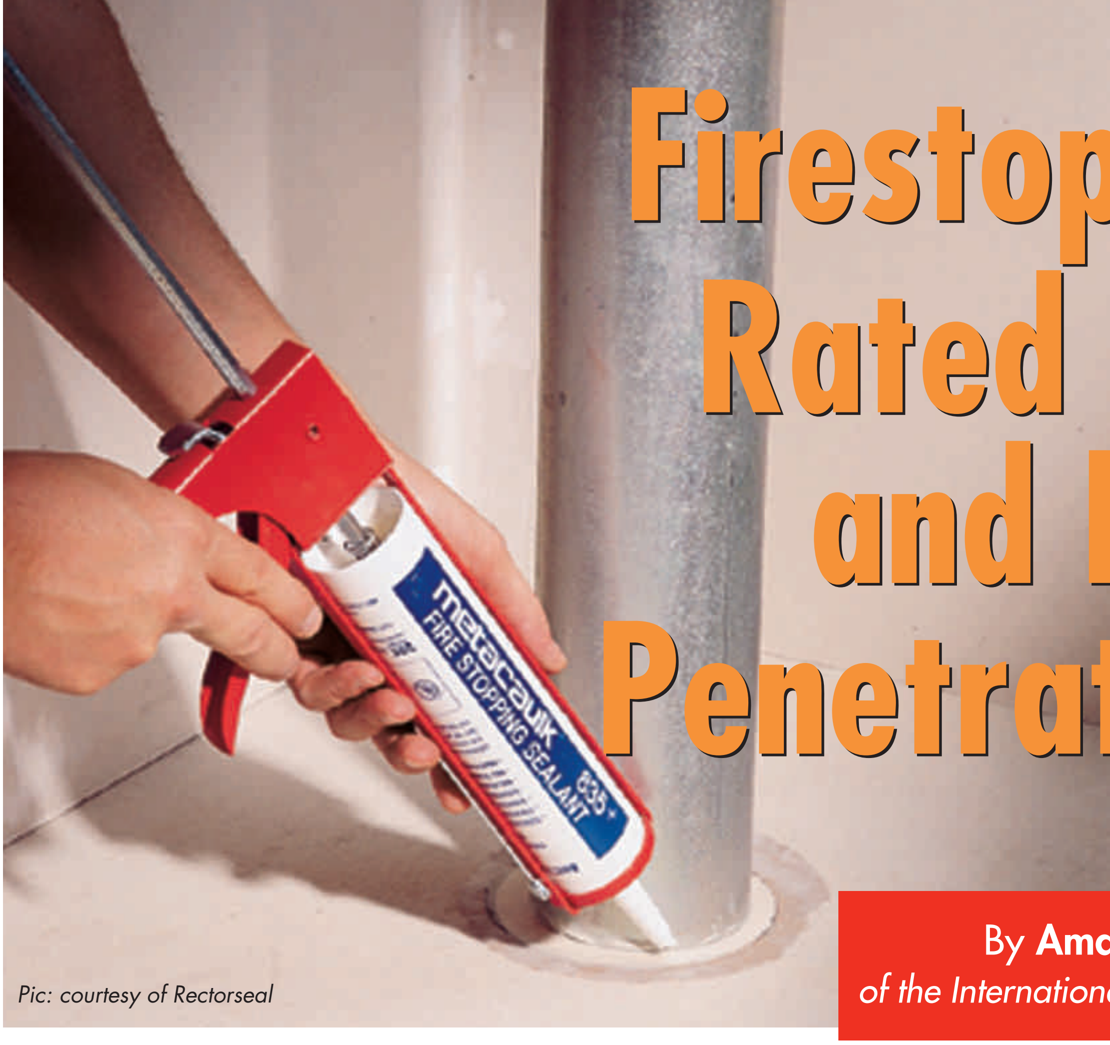
A complex network of hoses and pipes is used to move fluids – hydraulic, thermal and lubricating – within the press framework. All of these fluids are flammable and present the risk of spray, pool or combined fires. Heat-transfer fluid, for instance, is heated to approximately 500°F (260°C). After visiting one of the presses to observe it in action, the FM Global team and Minimax engineers conducted a series of tests on the proposed water-mist protection system in August 2000 at the Minimax research facility in Bad Oldesloe, Germany.

The team's goals were to verify that a water-mist system could control or extinguish spray and pool fires in the press pockets, as well as pool fires in the heat tunnels of the continuous-board press. Conditions that had to be met included:

- the stainless steel conveyor belt would not be damaged by the fire exposure or by any accidental activation of water-mist sprays in the heat tunnels, and other structural components of the press would not be damaged by fire.
- Mock-ups of heat tunnels and press pockets were built at the Minimax facility according to FM Global Research's test plan. Testing confirmed the effectiveness of the two water-mist spray configurations – one for protection of the press-pocket space and the other for the heat tunnels. The Minimax water-mist system extinguished the tested pool fires in the pocket space and the heat tunnel, and controlled the 6-megawatt spray fires in the pocket space. In addition, the press components, including the stainless steel conveyor belt, would not be damaged by fire.

"The customer and the manufacturer of the water-mist system were both based in Germany, so it made economic sense for us to travel there to conduct this testing," Yu explained. "This ultimately saved time, which is usually one of the most critical factors in applied research projects. For our customers, there's always a deadline – and time is definitely money – in every project like this. To repair a single section of the stainless steel conveyor belt can cost upwards of US$100,000, not including lost income from the downtime. This water-mist system is designed to reduce or prevent fire-related downtime."

> According to Yu, the best possible outcome of applied research is the fewest modifications to the proposed fire-protection design. "If we have to make changes," Yu said, "we try to keep them to a minimum, as long as the system meets the fire-protection performance requirements demanded by the application."



Pic: courtesy of Rectorseal

Firestopping Rated Wall and Floor Penetrations

By **Amal Tamim**
of the International Firestop Council

COMMERCIAL BUILDING CODES call for fire-resistant walls and floors that compartmentalize a structure into controlled segments in order to restrict the spread of flame and smoke in the event of a fire. However, rated spaces are commonly penetrated by wires, cables, pipes, ducts and structural elements, creating openings that compromise fire safety. Effective sealing is required to restore the intended rating. This article discusses categories of penetration fire-stopping, and the materials and systems that are available to accomplish effective penetration sealing.

Typically 80% of fire barrier penetrations in a commercial building relate to mechanical services such as electrical wiring, communication cabling, heating, ventilation and air conditioning components, as well as pipes for drains, venting, water, steam, and automatic fire sprinkler systems. Structural features including expansion joints, spaces between curtain walls and floor slabs and floor-to-wall joints also disrupt rated barriers and require fire-stopping.

A structural fire creates deadly forces including rising temperatures that can climb rapidly to more than 2000°F (1100°C), and toxic gases that quickly spread to fill confined spaces. The small openings in walls, floors and ceilings created by penetrations can act as blowtorches, spitting fire and poisonous smoke from one space to another. Smoke and toxic gas movement in a structure is one of the most serious issues in fire safety. Smoke migration can affect the occupants, search and rescue teams and fire fighters far sooner than flames and high temperatures.

Some kind of seal is clearly needed to restrict this rapid propagation through penetration openings. However, experience shows that conventional materials such as drywall mud, grout or caulks cannot maintain the integrity of a penetrated fire barrier because they dry out, shrink or crack due to expansion and contraction. Only a properly formulated, tested and correctly-installed penetration seal is capable of dependably restricting and stopping the spread of smoke and toxic combustion products under the difficult conditions of a fire.


Pic: courtesy of HILTI Inc

Code-approved penetration seal materials must be certified in accordance with nationally recognized standards, which involve severe testing to simulate fire emergency conditions. ASTM E814 (UL 1479), entitled *Fire Tests of Through-Penetration Fire-stops*, governs penetration seal material certification in the U.S. In Canada, CAN4-S115 is the controlling document for fire protection work. These industry standards define stringent performance specifications for approved fire protection systems, including requiring one side of a fire barrier penetration to be exposed to temperatures up 2000°F (1100°C) over one to four hours, depending on the application, without

Pic: courtesy of Rectorseal

allowing the fire to spread to the opposite side. In the US, approved fire protection systems must also be capable of withstanding the impact and rapid cooling effects of water from a high-pressure hose.

Some penetrating items are themselves prone to fire damage, including plastic pipes used for supply, drain and ventilation purposes. Unprotected plastic pipes will melt or burn to leave large gaps that quickly degrade fire safety. These create a particular challenge to the fire integrity of a rated barrier, due to large gaping holes than can be created within a short amount of time if the penetration is unprotected.

PENETRATION SEAL PROPERTIES

Approved penetration sealants are typically characterized by one or more of four properties: intumescence, endothermicity, ablation and insulation.

■ INTUMESCENT materials increase in volume when they are exposed to heat. A typical intumescent fire-stop product begins to swell at around 250°F (121°C), and reaches full expansion at levels of 1000°F (540°C) or above before they harden into a rigid material. This allows the seal to fill and close off a penetration in the event of fire.

■ ENDOTHERMIC penetration seal materials release chemically bound molecules of water as temperatures increase. A fire's heat drives water out of the endothermic material to help cool the area surrounding a penetration.

■ ABLATIVE penetration seal materials erode and harden under fire's heat to form an insulating char. The elastic nature of most ablative sealants makes them useful for filling relatively large penetration gaps and construction joints since they tolerate some mechanical displacement.

■ INSULATION MATERIALS include mineral wool and other very high temperature fibrous and dense materials that are extremely stable, and capable of withstanding very high temperatures without physical change.

PENETRATION SEAL PRODUCTS

The number of materials available for penetration sealing from fire protection manufacturers has grown substantially over the past few years. This product category now includes caulks and putties, sealants, tapes, joint strips, composite metal sheets, mechanical devices for plastic pipes, cast-in-place devices, and a variety of insulating bags, pillows and blocks.

■ CAULKS, PUTTIES, WRAP STRIPS AND TAPES for penetration fire-stopping commonly exhibit both intumescent and endothermic properties. Caulks are applied around penetrating items with a caulking gun to form a seal against fire, smoke, fumes and water, while putties are pressed into openings manually. Tapes and strips are wrapped around objects and gaps. These materials are generally used to seal penetration gaps created by cables, pipes, wires, ductwork and similar fire barrier penetrations.

■ COMPOSITE METAL SHEETS are useful for openings that are too large to be sealed with caulk or putty alone, such as large gaps in concrete or gypsum walls where conduit, pipes or ducts pass from one area to another. Composite sheet consists of galvanized metal panels sandwiched around an intumescent rubber matrix. Composite sheets are cut to fit closely around penetrating elements, fastened tightly to the fire barrier and sealed around the edges with rated putty or caulk.

■ Special PLASTIC PIPE DEVICES and related components are used to seal openings completely should a plastic pipe burn or melt. Such materials consist of metal supporting collars to hold an intumescent material in place around the pipe, as well wrap strips and putty to seal the annular space between the pipe and wall or floor surface.

■ Various FIRE-STOP SPRAYS, made of latex, or other formulations, are used for penetration situations such as curtain wall safing joints, expansion joints or head of wall joints where caulk is slow or awkward to install. These materials are typically intumescent and ablative formulations and can be sprayed or brushed into place to help control heat conduction, and restrict passage of smoke, gas and water. They are typically applied over a substrate of compressed mineral wool insulation that has been used to fill the gap. Firestop sprays are typically elastomeric and dry to form a flexible seal that can tolerate some vibration and movement.

■ FIRESTOP MORTAR is a plaster-like material that can be troweled, poured or pumped to fill large openings around pipes, cable trays and ductwork. It bonds to most surfaces and sets up to form a water-resistant barrier that does not shrink when drying or under the heat of a fire.

Pic: courtesy of Rectorseal

Pic: courtesy of Rectorseal

■ FIRESTOP FOAM is applied in a manner similar to caulk and is useful for firestopping small to medium sizes irregular or difficult to reach openings. This material expands to fill spaces that are unaccessible to conventional putty or caulk.

■ FIRESTOP PILLOWS, BAGS AND BLOCKS are used to fill large openings such as around pipes, ducts, cable bundles and cable trays. These items combine intumescence with insulating properties and are sometimes used in conjunction with other products including composite sheets and putties or other sealants. They are removable and replaceable, which is important for structural areas that may require reentry access.

■ CAST-IN-PLACE DEVICES are plastic or metallic sleeves that are cast into a concrete floor at the time of original construction. They contain an inlay of intumescent material needed to seal off the penetrating items in the event of a fire. The penetrating item is simply pushed through the device as building utilities are being installed. Such devices allow future retrofits without having to break through or destroy the sealants.

■ MINERAL WOOL is used to fill open spaces such as penetrations with large annular spaces or head-of-wall joints and at the intersection of edge of floor slabs with exterior walls. This material can be compressed and fit into place and its permanent resilience can withstand structural movement to remain permanently in place. Mineral wool is used to increase the thermal rating of the through-penetration fire-stop systems and provide backing to the sealant material.

A CONTINUING CHALLENGE

The effectiveness of penetration firestopping depends greatly on proper training and consistent installation methods that meet governing standards and comply with local codes. This work can be accomplished by specialty contractors, or by general contractors and sub-contractors who are trained and equipped to meet these standards. In either case the work should be subject to rigid inspection in accordance with governing codes and conform to ASTM standards (ASTM E-2174.). While penetration seals are generally installed at the time of construction or during rehabilitation, it is critical that there be ongoing attention to penetration seal details over the life of a building, since ongoing maintenance and service changes inevitably create new holes in fire-rated barriers and leave previously filled and sealed openings empty. Without proper attention to these penetrations, the integrity of the fire barriers can become critically compromised.

While there are dozens of qualified fire-stop materials and documented applications on the market, each construction project presents special situations that may not be precisely defined in established procedures. The major fire protection suppliers listed here are equipped with technical service departments that provide engineering judgments for such installations based on laboratory tests and product experience. These manufacturers generally offer application engineering assistance and on-site training to help contractors comply fully with penetration fire-stop code requirements.

Fire Protection Product and Service Suppliers

3M Fire Protection Products – www.mmm.com/firestop
207-1W-02 3M Center, St Paul MN 55016
651-733-5341

Fire Trak Corporation – www.firetrak.com
12098 City Rd. 150, Kimball, MN 55353 – 320-398-7800

Grace Construction Products – www.flamesafe.com
62 Whittemore Ave., Cambridge, MA 02140 – 617-498-4441

Hilti, Inc. – www.hilti.com
5400 S 122 E Ave., Tulsa, OK 74146 – 918-252-6202

Nelson Firestop Products – www.nelsonfirestop.com
4041 S. Sheridan, POB 726, Tulsa, OK 74101 – 800-331-7325

The Rectorseal Corporation – www.rectorseal.com
2601 Spenwick Drive, Houston, TX 77055 – 800-231-3345

Royal Quick Stop Fire Protection Systems – www.royplas.com
155 Regalcrest Court, Woodbridge, ON L4L8P3 – 905-856-7550

Roxul, Inc. – www-intumex.at
551Harrod Drive, Milton, Ontario L9T 3H3 Canada – 905-878-8474

Specified Technologies, Inc. – www.stifirestop.com
200 Evans Way, Suite 2, Somerville, NJ 08876 – 908-526-8000

Thermafiber – www.thermafiber.com
3711 W. Mill St. Ext., Wabash, IN 46992 – 219-563-2111

Thermal Ceramics – www.thermalceramics.com
PO Box 923, Augusta, GA 30903 – 796-796-4482

Tremco – www.tremcoinc.com
3735 Green Road, Beachwood, OH 44122 – 216-292-5000

Unifrax Corporation – www.unifrax.com
2351 Whirlpool St., Niagara Falls, NY 14305 – 716-278-3808

United States Gypsum Company – www.usg.com
125 S. Franklin, Dept 147-3, Chicago, IL 60606 – 312-606-4065

For more information, please contact:

International Firestop Council
www.firestop.org
Information: info@firestop.org

Enquiries: www.rectorseal.com

Enquiries: www.morley-ias.co.uk

Fire Pumps and Valves

by Mark Hopkins, P.E. and
Lawrence J. Wenzel, P.E., C.F.P.S., C.B.C.P.

This photo shows a typical fire pump installation. This installation includes an electrically driven pump. Notice that a person standing near the fire pump controller can clearly see the pump and its driver. This meets a specific requirement of NFPA 20-1999, Section 7-2.1

A SITUATION OCCURRED in a 10-story high-rise building in Florida. The water demand for the building's sprinkler system required the contractor to install a fire pump. However, the design of the combined standpipe and sprinkler system piping could not withstand the pressure increase provided by the fire pump.

The design included an electric motor-driven fire pump, capable of flowing 1000 gallons per minute (gpm) at a discharge pressure of 130 pounds per square inch (psi). The municipal water system supplied a static pressure of 55 psi and a flow of 1000 gpm with a residual pressure of 43 psi at the pump suction flange. This provides a combined pressure of 173 psi at the discharge side of the fire pump when the pump flows 1000 gpm. Because this particular pump provides 120% of the rated pressure with no water flowing – sometimes called the "shutoff" or "churn" condition – the pressure rises to 210 psi. Thus with little water flowing, such as when a single sprinkler head operates in the early stages of a fire, the piping must endure relatively high pressure.

Rather than using piping and equipment rated for the higher pressures, as required by NFPA 20 – 1999, *Standard for the Installation of Stationary Pumps for Fire Protection*, the contractor chose to rely on a fire pump relief valve. He set the relief valve to operate at 175 psi. The contractor reasoned that this arrangement would allow him to use standard piping and equipment rated for 175 psi. Obviously, this would reduce the installation cost of the fire protection systems.

Sadly, using a fire pump relief valve to maintain the system pressure at or below 175 psi does not comply with the requirements of the Standard. NFPA 20-1999, Section 2-2.4 states, *"The net pump shutoff (churn) pressure plus the maximum static suction pressure, adjusted for elevation, shall not exceed the pressure for which the system components are rated".* The supporting information in Appendix A, Section A-2-2.4 specifically identifies the use of a relief valve to reduce the overall pump operating pressure as a "poor design practice."

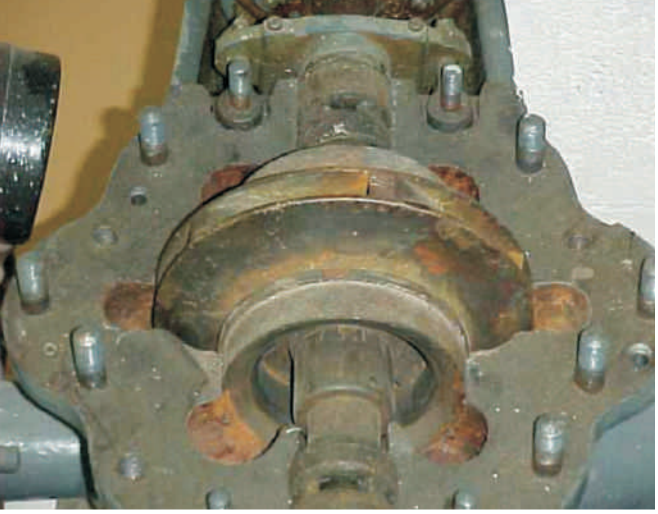
Unfortunately, no one discovered this design flaw until the day before the scheduled opening of the building. In fact, the discovery occurred just as the contractor had begun to prepare for the acceptance testing of the pump. Based on this information, the Authority Having Jurisdiction declined to accept the system. This prevented the building from opening on time.

The contractor and the design engineer now had to face the problem of correcting the design flaw. They had limited options available. They could replace the system piping for the standpipe and sprinkler systems on the lower levels of the building. Or, they could add one or more pressure reducing valves.

Fire Pumps

A common misconception exists that fire pumps can add "capacity" to volume-deficient water supplies. Fire pumps do not create water. Thus, if an insufficient quantity of water exists to supply the pump, the pump will do no good. Fire pumps simply add energy to increase the pressure for a given volume of water.

Contractors install fire pumps where a water supply has a *pressure deficiency* for fire protection or manual fire fighting needs. This condition may occur where the water supply must come from a low-pressure static water source, such as a low-pressure public water system. In the past, fire pumps supplied by a connection to a public or private water distribution system or to a gravity tank have often been referred to as "booster pumps." While still in use, NFPA 20 – 1999, no longer uses



The open casing of this horizontal split case pump clearly shows the impeller. The shaft from the driver connects to the pump shaft. The impeller mounts on this shaft

this term. Other typical low-pressure suction sources include ponds, reservoirs, cisterns, wells, low elevation ground storage tanks or, in some rare cases, swimming pools.

To accommodate application needs, a contractor may use a variety of pump types for fire protection. Today, most contractors use centrifugal fire pumps, including horizontal split case, vertical line shaft turbine, vertical in-line, and end suction pumps. In certain specific applications, a contractor may use positive displacement fire pumps. These specific applications include certain foam systems and water mist systems. The new chapter 5 of NFPA 20 – 1999 provides specific requirements.

All fire pump installations consist of three basic components: the *driver*, the *pump* and the *controller*.

The driver converts energy supplied from an electrical motor, fuel-fired engine or steam turbine into mechanical force used to rotate the pump shaft. The driver connects to the pump shaft through a flexible coupling.

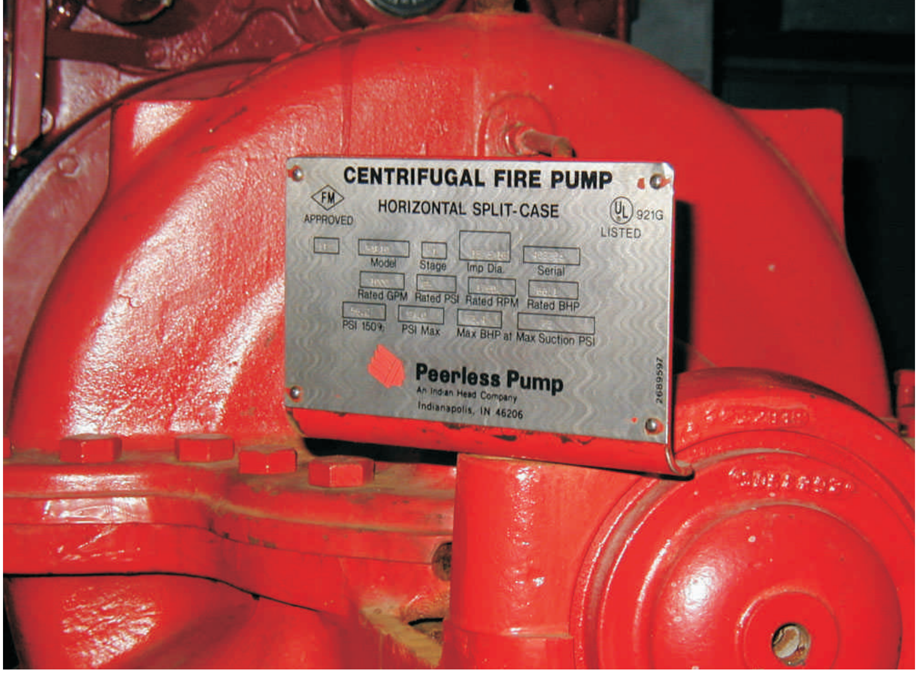
The centrifugal pump – the most commonly used type of pump in fire protection – converts the rotational energy provided by the driver into kinetic energy using a "disc" known as an *impeller*. Positive displacement pumps create pressure by compressing the water in a chamber and then releasing it into the system.

The controller serves as the "brain" of the installation. It works as a true "management tool", starting and sometimes, stopping the pump. It also acts as a remote signalling point when supervisory initiating device circuits from the facility fire alarm system connect to supervisory signalling contacts in the controller. In essence, the controller keeps an eye on the fire protection system water supply, through its ability to monitor system pressure. If the pressure drops, the fire pump controller starts the fire pump, boosting the pressure.

Fire Pump Capacities

Fire pumps range in flow capacity from 25 gpm to 5000 gpm and net pressure delivery of 40 psi or greater, as identified in NFPA 20 – 1999, Section 2-3. They must meet specific flow and pressure delivery points, as part of their Underwriters Laboratories Inc. (UL) listing. The rated capacity of the pump determines these delivery points. The nameplate of the pump always contains this information.

NFPA 20 – 1999 specifies pressure limits at no-flow conditions between 101% and 140% of the rated nameplate pressure. At 65% of the rated pressure, the pump must deliver 150%



The manufacturer often mounts the fire pump nameplate directly on the pump casing

of the rated flow. NFPA 20-1999 states these requirements in section 3.2, and in the appendix to this section.

Sizing Fire Pumps

A designer should consider several factors when sizing a fire pump for a given design application. The designer does not have to size the fire pump to meet the *exact* system demand. NFPA 20 – 1999, section A-2-3 states that fire pumps must be able to operate at any capacity between churn to 150%. However, a designer should select a fire pump for a given application within the range of 90 to 140% of rated pump capacity. This allows for some flexibility in the event that the suction supply changes.

As in the example at the start of this article, a common mistake occurs when a designer does not properly specify the pressure ratings for pipe and fittings based on the sizing of the fire pump. The maximum net pressure increase provided by a fire pump occurs while the pump operates at a no-flow condition.

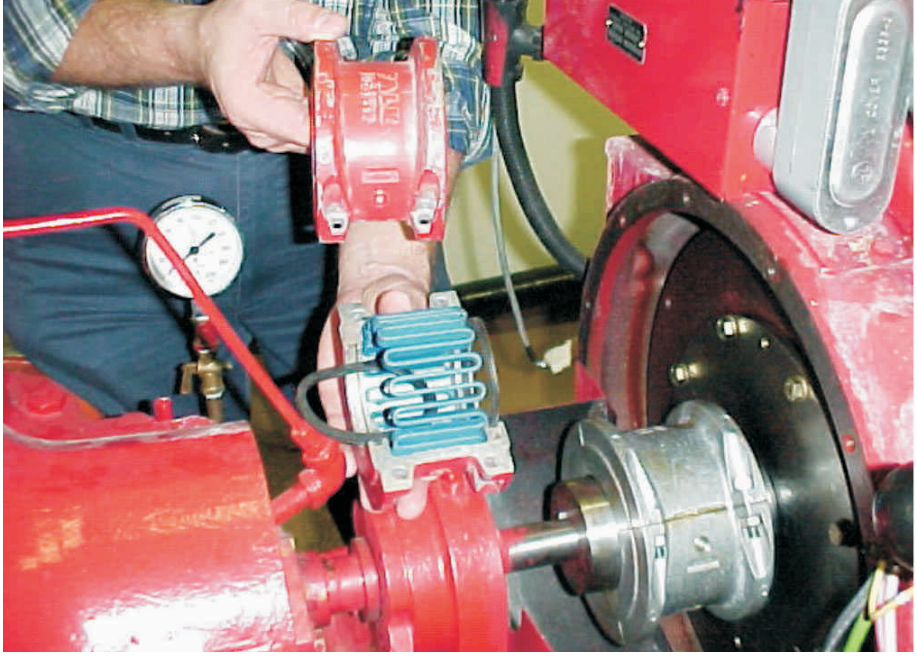
To determine if the system pressure will exceed the pressure ratings of the pipe and fittings, the designer must add the available static water supply pressure to the pump's no flow pressure. Then, the designer must compare this total pressure to the rated allowable pressure listed for the piping, valves and other components.

Relief Valves

A fire pump system relief valve serves as a safety device. It should only need to open when an "over-speed" condition of the fire pump driver can result in pressure exceeding the maximum working pressure for the piping and equipment installed. An electric motor can't over-speed; thus, a designer need not specify a system relief valve for an electric motor driven fire pump installation.

The designer must use a little math to determine if he or she must specify a system relief valve for a diesel engine driven fire pump installation. NFPA 20-1999, Section 2-13.1 gives the formula. The designer must compare the maximum working pressure for the piping to the *sum* obtained by adding the static pressure to 121% of the net no-flow (churn or shut-off) pressure.

Keep in mind that, as in the example outlined at the beginning of this article, the installation of a relief valve should not serve as a design option to reduce project installation costs.

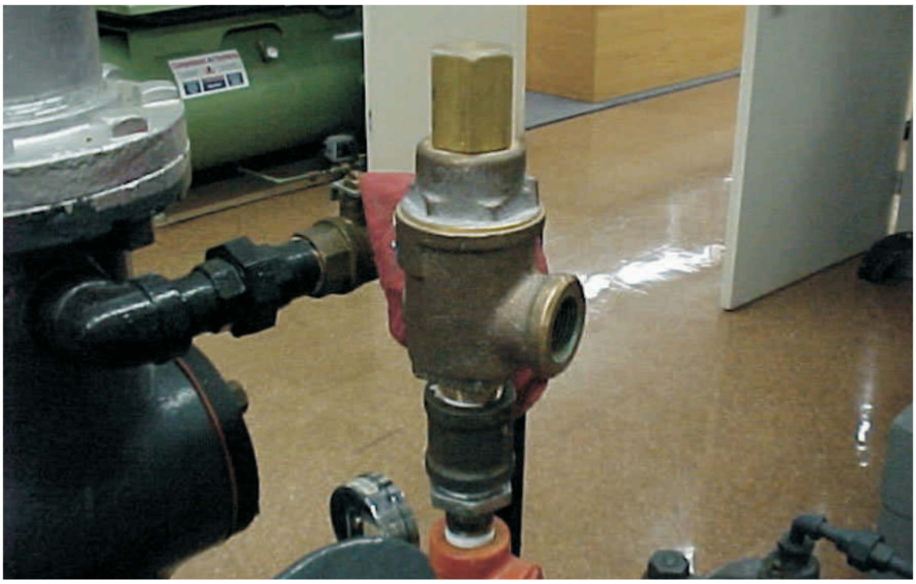


The flexible coupling serves as a very important component for any fire pump installation. It allows the power from the driver to transfer to the pump. If this component fails, then the pump cannot supply water. The installer must carefully align the flexible coupling. Whoever maintains the pump must make certain the alignment remains proper

The designer must also consider some other operating conditions. When the fire pump operates at a no-flow condition, the fire pump itself can heat up. The fire pump impeller generates heat as it turns. The heat builds up if no cool water flows through the pump casing. This elevated temperature in the pump casing can cause damage. Thus, water must constantly pass through the pump. The designer must provide a method to keep the pump cool.

The designer can do this by supplying the water for the diesel engine cooling system from the discharge side of the pump. As the water flows from the pump discharge, through a heat exchanger connected to the closed circulation engine cooling system, it will also dissipate any heat that may build up inside the casing of the pump.

However, electric motor driven pumps, and engine driven pumps that use a radiator for cooling do not offer this benefit. Thus, the designer will have to specify a circulation relief valve, also known as a case or casing relief valve, to keep the pump casing cool under no flow conditions. A circulation relief valve consists of a small diameter relief valve designed to provide a small flow through the pump to waste. The contractor usually attaches this circulation relief valve to the pump casing. However, the contractor may also install this valve anywhere on the discharge side of the pump.



This circulation relief valve mounts on top of the fire pump casing. It should have a discharge pipe from the outlet to a safe location

Control Valves

Lastly, the designer will specify the use of control and check valves to isolate fire pumps and other water supplies from one another and to allow for service and maintenance of installation components. Valves used in fire protection systems must bear a UL or FM listing mark for fire protection service.

The designer may specify either indicating butterfly or gate valves. The designer should specify valves to isolate the pump from the supply and discharge, and to allow maintenance personnel to completely remove the pump from the fire protection piping system. Appropriately located valves will also allow for pump testing without removing the pump from service.

NFPA 20-1999 disallows the use of a butterfly valve in one specific instance. The designer may only specify the use of an indicating gate valve in the suction line within fifty feet of the pump. Butterfly valves can create turbulence. This turbulence in the suction supply could adversely affect the performance of the fire pump. However, the Standard permits the use of listed butterfly valves as control valves in all other locations.

The designer will specify the installation of check valves on the discharge side of fire pumps and jockey pumps. These check valves will isolate the water supplies. They will also allow the jockey pump to maintain higher pressure in the fire protection system. This higher pressure in the system, coupled with higher starting pressures for the fire pump, will effectively eliminate water hammer. By maintaining higher pressure on the system, the fire pump can automatically start at higher pressure. This will provide higher operating pressure for automatic sprinklers and hose lines earlier in a fire.

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3M Halon Replacement

on Fast Track to Global Market Acceptance as the only Sustainable Halocarbon Alternative to Halon

Chemistry Offers Unique Combination of Environmental, Safety and Performance Advantages

3M Specialty Materials has announced that 3M™ Novec™ 1230 Fire Protection Fluid, a halon alternative introduced at last year's NFPA Exposition, is quickly receiving global market acceptance as a result of the material's favorable environmental profile, wide margin of safety and unique performance advantages.

Novec 1230 fluid is quickly receiving acceptance from global regulatory agencies in large part because it offers the lowest global warming potential and the shortest atmospheric lifetime of any halocarbon agent currently on the market. 3M has submitted the necessary registration for pre-manufacturing notification and Significant New Alternatives Policy program clearance with the Unites States Environmental Protection Agency. In addition, 3M has submitted the necessary registration for European List of Notified Chemical Substances (ELINCS) clearance from the European Union. Novec 1230 has completed a witnessed Underwriters Laboratories (UL) 2166 fire test protocol for flooding applications making it the first liquid clean agent to successfully do so.

"3M has received an overwhelming amount of support for Novec 1230 fluid primarily because of its desirable environmental profile. It has a five-day atmospheric lifetime compared to the next best chemistry that persists in the environment for 33 years," said Larry Wendling, general manager, 3M Performance Materials Division. "Coupled with a global warming potential of one and zero ozone depletion potential, we believe Novec 1230 fluid overcomes most of the global regulatory obstacles faced by conventional halon replacements."

Novec 1230 fluid is a fluoroketone, a proprietary 3M technology that is being developed for a number of industrial applications. The unique chemical structure of these materials offers several key advantages in the area of fire protection, including excellent extinguishing performance in both streaming and flooding applications. Novec 1230 fluid is also low in acute toxicity, providing a significant margin of safety at expected design concentrations making it suitable for protecting occupied spaces.

3M offers global customer support for Novec 1230 fluid and will take back and properly dispose of unused, old or overstocked fluid. Novec 1230 fluid is available globally.

3M is a diversified technology company with sales of more than $16 billion. Celebrating its 100th anniversary, 3M has operations in more than 60 countries. Headquartered in St. Paul, Minn., 3M manufactures products serving industrial, commercial, health care and consumer markets.

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New Generation Fixed Fire Protection Systems


Pic: courtesy of Kidde Fire Protection

by Dr Dave Smith
Business Development Manager, Kidde Products

NEW GENERATION AGENTS

There is no single 'total flooding' agent which has emerged as the clear successor to Halon 1301, largely because there is no direct equivalent and, hence, no 'drop-in' analogue. This has led to a more complex decision-making process in developing fire protection solutions but has had the positive effect of increasing emphasis on fire risk analysis and provision of the integrated systems package which is right for each specific application.

We focus here largely on the key new generation gaseous total flooding agents. In doing so, we recognise other traditional media such as dry powder, sprinklers and foam which remain vitally important but are what we might term 'not in kind' agents relative to Halon. We also acknowledge the use of carbon dioxide but do not discuss this option here in detail as it well known historically and cannot be used in normally manned areas. This leads us to consider the two types of total flooding agents: the liquefiable chemical gases and non-liquefiable inert gases. All viable gases of either designation have a zero ozone depletion potential [ODP] and a varying series of attributes which places them at the forefront of the present fixed systems market.

Within this context, the term 'viable gases' refers to those which are environmentally-acceptable, are clean gases at ambient temperatures and offer efficient fire extinction performance at concentrations below defined human toxicity levels. Furthermore, they are recognised in current standards [including BS ISO 14520] and are available in third party-approved systems.

CHEMICAL GASES

HFC 227ea is, by some measure, the most prevalent of the chemical agents globally and has been manufactured by Great Lakes Chemical Corporation since 1993 under the trade name FM-200. It lacks the ozone-depleting presence of bromine atoms, which precipitated Halon's demise and acts on fires by largely physical means, its heat absorption capability lowering the flame temperature such that the combustion process cannot proceed.

The minimum FM-200 concentration needed for typical Class A surface fires is 7.5% which is the experimentally determined extinguishing concentration

New Generation Fixed Fire Protection Systems

plus a 30% safety factor. It poses no asphyxiation threat to human safety and is non-toxic with reference to its No Observable Adverse Effect Level [NOAEL] of 9% and Lowest Observable Adverse Effect Level [LOAEL] of 10.5%. As such, it may be used in occupied areas up to the NOAEL without mandated egress times and then up to the LOAEL provided that personnel are exposed for no greater than five minutes.

Since the agent is non-corrosive and electrically non-conductive, it lends itself ideally to a wide range of high value assets including computer suites, EDP and IT facilities, data storage rooms, archive areas, control centres, art galleries and museums.

The systems themselves comprise one or more cylinder/valve assemblies, each of typically 5-250 L capacity containing liquid agent under a nitrogen pressure of 25 bar [although there are some systems at 42 bar]. A particular advantage of FM-200 systems is the minimal storage requirement of around 1.5 times that of Halon 1301, which compares favourably with all other viable systems.

Pic: courtesy of Kidde Fire Protection

All gaseous discharges result in some pressure excursions in the enclosure during and immediately after release of agent. Since the concentrations of FM-200 are relatively low, there is commonly no requirement to provide over-pressure venting.

A further advantage arises from the requirement in the standards for chemical gas systems to discharge within ten seconds. This rapid discharge ensures fast fire extinguishment and can be invaluable when rapid-fire growth is possible or where secondary heat and smoke damage to sensitive equipment must be minimised. In some cases, therefore, the use of FM-200 can minimise business interruption, limit data loss and ensure the lowest cost in resuming activities after a fire event.

The only other viable total flooding chemical gas to date has been HFC-23, marketed by Du Pont under the trade name FE-13. System designs follow broadly the same principle as for FM-200 but FE-13 has a vapour pressure of around 42 bar at normal room temperature and requires no nitrogen superpressurisation. It is the market leader in Spain, for example, and offers exceptional performance in a number of challenging circumstances including low temperature and high ceiling applications. As a result, HFC-23 has found use worldwide in the oil and gas industry and on large industrial vehicles.

INERT GASES

These agents are non-corrosive and electrically non-conductive but differ from the chemical gases in a number of respects. Being non-liquefiable, they are stored at high pressures typically of 150-300 bar. With no appreciable chemical action on fires, they are physically acting but rely on oxygen-depletion, reducing the O_2 concentration to around 14% at which combustion is inhibited.

There are several inert gases available which feature argon and nitrogen, singly or in combination, with one of these containing a small proportion of carbon dioxide. Examples include those designated IG-01 [pure argon], IG-55 [a 50/50 mix of argon and nitrogen] and IG-541 [the argon/nitrogen/carbon dioxide blend].

Pic: courtesy of Kidde Fire Protection

Design concentrations for Class A surface fires vary according to the specific agent but are rather higher than for chemical gases at around 40%. NOAEL and LOAEL data derived from oxygen depletion considerations are 43% and 52% respectively; hence they are safe at normal design concentrations.

Owing to the significant volume of agent to be deployed, discharge times are usually one minute. The need to avoid significant pressure excursions and allow for displacement of air means that dedicated venting is invariably required, the dimensions of which are calculable at the system design stage.

Although the number of cylinders needed relative to Halon 1301 is quite high, these agents flow very readily through the discharge manifold, which allows very remote storage of the system from the fire risk. Ease of flow enables also the engineering of complex agent distribution paths for geometrically challenging applications and, for independent multiple zone protection, central storage systems which protect one or more areas via distribution valves.

WATER MIST SYSTEMS

Although Water Mist is clearly not a clean gas, we discuss these systems here as they hold an important position in the range of new generation agents.

In Water Mist systems, the liquid is atomised to produce droplets of ca. 50-200 micron diameter, these being an order of magnitude lower than in sprinklers and providing a much greater water surface area per unit volume for heat absorption. Action on fires is through cooling of the fuel and flame

Pic: courtesy of Kidde Fire Protection

and, to a greater or lesser extent, inertion in the flame region by steam. As a result, these systems offer fire extinguishment through discharges of limited duration and, therefore, using less water than associated with sprinklers.

A number of Water Mist systems are available comprising cylinders containing water and pressurised with nitrogen [or air] or which receive pressurisation from a separate gas container. In some cases, water is electrically pumped through the discharge manifold from a dedicated or shared [e.g. mains] water source. Design of the spray nozzles defines the agent flow rate and also the droplet sizes and their discharge velocities. In single fluid systems, atomisation is achieved by passage of pressurised water alone through the nozzles, pressures ranging from just a few bar to possibly several hundred bar. In twin-fluid systems, flow of water into the nozzles at typically 3-5 bar is accompanied by an atomising gas at around the same pressure. While twin fluid systems are more complex in design, they offer very effective atomisation at low pressures and significant momentum of the discharge plume.

Pic: courtesy of Kidde Fire Protection

There are several classes of 'new generation' agents, including Novec 1230 from 3M which may well become a key option for fixed systems

Systems tend to be customised for local application onto generators, turbines and other items of machinery subject to Class B [liquid hydrocarbon] fires. End users must exercise caution in accepting systems purporting to be 'total flooding' since Water Mist is not a gas and cannot readily penetrate to obstructed fires. In these cases, the client must understand what level of fire protection is afforded and whether fire tests and approvals associated with the system in question underpin the performance claimed.

CLOSING COMMENTS

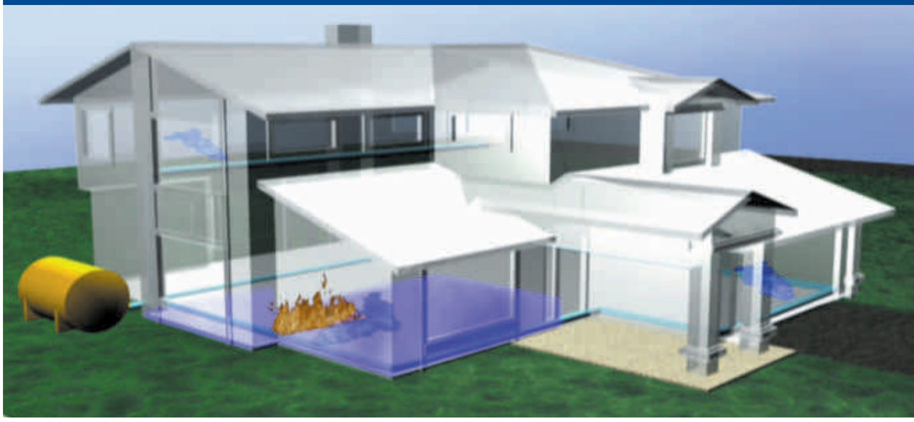
Fixed fire protection remains, as ever, in a dynamic state. Recent developments in chemical gases include a Kidde Advanced Delivery System [ADS] for FM-200 which enables a greatly improved mass flow rate of the agent. This offers greater flexibility in system design and lengthier and more complex distribution of agent from a single source as well as allowing use of smaller diameter pipework to give installation cost savings. In addition, there are several classes of 'new generation' agents, including Novec 1230 from 3M which may well become a key option for fixed systems. For inert gases, both lower and higher pressure systems have entered the market relatively recently, the former to utilise Halon pipework where appropriate and the latter to reduce cylinder capacity requirements.

Other issues associated with gas systems include, in Europe, meeting requirements of the Construction Products Directive [CPD], the Pressure Equipment Directive [PED] and its transportable equivalent [TPED]. A host of EN components standards are in various stages of publication and will be completed within the next 2-3 years. Current standards for fixed gas systems are ISO 14520 issued in 2000 [adopted as BS in 2001] and NFPA 2001. In Europe, work is in progress on a CEN standard due for public comment later this year.

Of course, Halon phase-out requires not only replacement systems but also safe and environmentally sound removal of the Halon for destruction or reclamation for essential use. In the UK, DASCEM, an organisation previously responsible for Halon recovery and destruction in Australia, has joined forces with Kidde and Specialist Pipework Installations [SPI] to offer an integrated cradle-to-grave service. The destruction process itself involves high temperature plasma technology, which offers 99.999% conversion of Halon ultimately to harmless by-products.

We should not forget also the continuing use of carbon dioxide in fixed systems. While these systems have changed little over many years, they retain a key role in fire protection for good reason. For unmanned areas, they often represent the most cost-effective solution and, unlike the new generation gas systems, can be used for local application to protect a wide range of unenclosed machinery units.

In summary, therefore, there is a range of solutions available which meet the ever-growing demands for high value asset protection. The protection of life, property and the environment continues to be achieved through the application of effective, clean, safe and economical fixed gaseous systems.



FirePASS®

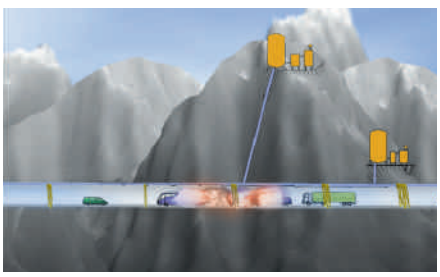
Fire Prevention and Suppression Systems

FirePASS® – a revolutionary new fire safety technology developed and patented by the FirePASS Corporation that resolves the complicated problem of fire safety in human occupied facilities and can help minimise structural damage and loss of life in terrorist attacks.

This system is not only 100% effective in preventing and instantly extinguishing fire of any possible origin and size, but is also completely safe for people. It's user friendly and does not cause any damage to equipment or property.

Remarkably the manufacturers of the new FirePASS® system state that **"it creates an atmosphere that is totally safe for humans to breath, but in which nothing can ignite or burn."**

FirePASS® technology can be configured to provide the ultimate fire protection for any application, including aircraft, transport tunnels, vehicles, marine vessels, banks, museums, libraries, apartment and office complexes, as well as hospitals, private homes and other human occupied venues for living, working, travel, sport or entertainment.



Pic: courtesy of FirePASS Corporation

FirePASS Corporation claims that many of the world's biggest disasters could have been avoided if FirePASS® Systems had been installed. . . . The World Trade Centre, Swiss Alps Tunnel Fire, The Windsor Castle Fire.

The FirePASS® system can be custom built and delivered for facilities of any kind and size.

The FirePASS® agent corresponds to air-nitrogen gas mixtures that are already listed in the NFPA standard 2001 "Clean Agent Fire Extinguishing Systems". The agent used for preventative purposes, FirePASS – PA (Preventative) presents oxygen depleted or nitrogen enriched air, containing 15-16% O_2. The agent used for suppressive purposes, FirePASS – SA (suppressive) presents oxygen-depleted or nitrogen enriched air, containing 10-12% O_2.

Both FirePASS-PA and FirePASS-SA agents consist of breathable atmospheric air that has been filtered and processed by hypoxic generators in order to produce breathable fire-suppressive hypoxic agent with preset, safe oxygen content. Hypoxic generators manufactured by Hypoxico/ FirePASS consortium extract part of the oxygen from ambient air using the PSA (Pressure Swing Adsorption) process that is precisely controlled. Nothing is added to the air during this process, no artificial components are mixed with the FirePASS agent.

At 16% oxygen the FirePASS fire-preventative normobaric hypoxic environment provides reliable fire prevention in normally occupied facilities. Hypoxic generators continuously produce the amount of agent necessary to provide effective ventilation of the protected space.

In the suppression mode an effective discharge of stored 10-12% oxygen content will extinguish surface burning fire in Class A, B and C hazards. The system can be activated by detection and control equipment for automatic system operation and also provides local and remote manual operation as needed. The system can be engineered for preventative or suppressive mode as well as for a combination of both.

There are many advantages of the FirePASS® technology in comparison to other existing fire-suppression systems. The first is that it's fire preventative and suppressive agent is produced on site by hypoxic generators that consume nothing but electric energy or, alternatively, pressurised air supplied from a remote air compressor. There are no transportation or refilling problems, low maintenance costs, simple integration into the existing structural configurations

FirePASS agent is a breathable hypoxic (Low-Oxygen) air that contains enough oxygen to provide normal physiological breathing, but will not support ignition and combustion of common flammable materials. The FirePASS® agent is derived from gases present in the Earth's atmosphere (Nitrogen, Oxygen, traces of argon, and other gases), therefore it exhibits no Ozone depleting potential and does not contribute to global warming, nor does it decompose into a unique chemical species with extended atmospheric lifetimes.

FirePASS® agent does not pose the problems of inhalation toxicity, usually associated with thermal decomposition of chemically derived Halon alternative agents.

FirePASS® satisfies all important clean agent properties required by the NFPA Standard 2001 "Clean Agent Fire Extinguishing Systems".

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FIRE AND SECURITY

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We've called the technology "SelfVerify" because the system verifies itself.

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AUTRONICA FIRE AND SECURITY

Making Light Work of Partitions

Focus on Fire-Resistant Glass

Mike Wood of Pilkington Pyrostop reviews the importance of fire-resistant glass in building design. He defines the key questions and calls for a careful look at the differences between the different types as fire-resistant glazing is increasingly used for a better fire-safe built environment.

Fire doors with Pilkington Pyrostop™ between the main hall and the shopping arcades

The inspiration for this article took shape whilst I was sitting idly in the main concourse of Düsseldorf Airport early one morning in July, trying to come to terms with a four hour delay in my flight to Paris. Irritated certainly but at least with time to reflect and look around. What's immediately apparent in Düsseldorf International is the large size of the building, its soaring roof structure of tubular steel and glass, its openness, freshness and spaciousness. These are connected themes that each of the daily 60,000 passengers experiences as he or she passes from check-in through security along the open transfer concourses down to and through the departure gates. The building environment is cool, bright, comfortable, filled with light – and above all, a safe environment protected against fire. In fact the new airport building, officially opened this year, is somewhat of a pioneer in the development of fire protection concepts. In April 1996 there was a major fire, killing seventeen people, causing extensive damage and resulting in serious traffic restrictions for more than a year. The lessons have been well taken to heart in what is now a very impressive new flight centre.

Fire-resistant glass is an essential element in the modern building design of Düsseldorf Airport. It has a central role to play in creating a light-filled and open building that doesn't compromise on fire safety and achieves the required degree of fire protection compartmentation. Extensive use has been made of the unique properties of fire–resistant glass in floor to ceiling partitions, all glass doors, vision panels, atria glazing, corridors and transfer bridges. The objective is to channel light into the interior and give all round through vision to the surroundings so that the passengers don't feel closed in. There is absolutely no reason at all why a 30 minute insulation with integrity performance fire protection partition can't be made out of glass. Levels of insulation with integrity performance of 60, 90, 120, and even 180 minutes are also possible provided that the right glass is chosen in a framing system designed for the job. Integrity performance is also achievable. It's even possible to construct fire protection floors and roofs using the same technology. Fulfilling the principles of fire protection compartmentation no longer means dark, depressing, and enclosed rooms or corridors where the occupant's anxiety an only be increased by the feeling of entrapment.

How can glass be made fire resistant? Glass isn't naturally stable in a fire. It isn't refractory; it softens with temperature and is susceptible to quite mild thermal shock or thermal stress, certainly at the levels likely to be experienced in a fire. Normal annealed glass either single glazed or double-glazed will simply crack, in fact quite early in a fire. Even toughened glass, a traditional glass for impact safety, can shatter if the thermal stress or shock should

exceed the critical fracture strength. This is always a distinct possibility in a fire. What is more, even if the toughened glass survives the initial shock then the original tension built into the glass on manufacture will relax and the original toughened strength will decrease as the heat builds up, so that in effect the glass can start to de-toughen. If fracture of toughened glass occurs then it will be early on. And its failure is dramatic: there is explosive destruction as the pent-up energy created in the toughening process is rapidly released, producing just a hole and a pile of glass pieces where the glass partition used to be. In a fire, where the exact heat intensity is unpredictable, that's an unnecessary risk that few would really choose to take, no matter how low the chance might be.

To achieve the high levels of fire resistance required of a fire-resistant glass in a fire, a rather special high performance technology is required. For the non-glass specialist there are three key aspects to keep in mind.

1 SYSTEM THINKING

Fire-resistant glass must only be used as part of an approved assembly, which means the glass, the frame, the glazing materials, the beads, the bead fixings and the fixings to the surrounding structure, all taken together as an integral fire protection system. The final result is greater than the sum total of the individual parts. The system must be assembled and installed exactly as approved and specified by the manufacturer. Mixing and matching of individual components between different systems can be dangerous as separate components might not be compatible or suitable. Unauthorised changes to approved systems are not allowed. Testing experience shows that even apparently small changes on the face of things can have a big impact in terms of achieved fire performance.

2 CHOOSE THE RIGHT HORSE TO BACK

There is no such thing as a generic fire-resistant glass. There are significant and important differences between the different types, even though they may have at face value the same performance

Even toughened glass, a traditional glass for impact safety, can shatter if the thermal stress or shock should exceed the critical fracture strength

classification. The same classification doesn't mean that the limits of performance, the reliability and consistency are necessarily the same. What is achieved with one fire-resistant glass may not be achievable with another. The technical specifications and performance capabilities can be significantly

Internal façade of the main hall glazed with Pilkington **Pyrostop**™

different in important respects, as can the framing details. Tested approvals only apply to particular configurations, glazing sizes, and aspect ratios. How one type of fire-resistant glass reacts in a fire can be entirely different from another.

3 CONFIDENCE IN THE PRODUCT

What is frequently overlooked is that only one test report, or even just a handful, is not a ringing endorsement that the product will necessarily perform consistently and reliably in a fire. The test report refers only to a specific test on a particular day. UK test reports draw attention to this point: "The results relate only to the behaviour of the specimen of the element of construction under the particular conditions of the test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use, nor do they reflect the actual behaviour in fires. The test results apply only to the specimen tested." Also, look very carefully at performance claims based in large measure on so-called assessment reports. These are opinions expressed by a "fire expert". The reference to tested data may in fact be tenuous, possibly second or third hand.

Against this background, how can you be sure that you have selected the right product? "Right product" means one that is demonstrated fit for purpose, with a demonstrated consistent and reliable performance. Well, start with a product that is well tried, tested and trusted. Look for the product's test track record: How many approvals have been gained, in how many different types of systems, with how many dif-

Transfer bridges at the departure gates with fire-resistant glazing used in the 5m wide connections to guard against fire spread to the mian building

ferent types of framing materials, over how many years, and in how many countries? Is there actually any direct experience of how the product has performed in a real fire? Look at the reputation of the supplier company and what they stand for. Ask the manufacturer about his factory quality production control system and the degree to which internal control fire testing on the product is undertaken. Is that daily, weekly, monthly or when they just feel like it? Is the product certified at point of manufacture by a proper independent third party scheme? Question how the product audit testing and process surveillance is carried out: Is the process properly defined and followed by an independent body according to independently defined national standards? Or, are corners cut in the interests of commercial interests? Overall, don't rely on just one factor alone. You can also make a judgment depending on how willing the manufacturer is prepared to go into such details. A responsible supplier, with care for his product and his obligations, would normally be only be too glad to go through his product's record and endorsements or commendations. Ask the manufacturer exactly how his fire-resistant glass works in a fire and what it depends upon. Finally, ask if he would literally stand by his product in a fire. After all, lives may depend on it.

Now we've arrived at Paris Charles de Gaule, Terminal No. 1, and a set of airport buildings of a totally different vintage, opened in March 1974. The difference is immediately apparent in the sprawling arrival/departure satellite stations, the roughcast monolithic concrete roof, the long dark transfer tunnels without external views, and the limited strips of external glazing. By contrasting Charles de Gaule with Düsseldorf, the advances in building design that has taken place over twenty-five years or so are readily apparent.

There has been a quiet revolution due to the increased use of both internal and external glazing for an improved built environment. Fire-resistant glass has played an important role in this development and will continue to do so. Now's the time, to get more familiar with its capabilities.

Fire Protection Has N

THEY ARE THE MOST AESTHETICALLY APPEALING options available in fire protection, but do concealed sprinklers offer the performance of exposed sprinklers when fighting a fire? To answer this question, we need to look more closely at the capabilities of concealed sprinklers, the applications where they are typically used, and weigh the advantages and the disadvantages of using concealed sprinklers.

By Scott Franson and Sandi Wake of The Viking Corporation

Multiple-sizes cover plates are especially convenient when replacing sprinklers in the field

WHAT IS A CONCEALED SPRINKLER?

NFPA 13 defines a concealed sprinkler as "A recessed sprinkler with cover plates." This means that the operating mechanism is either partially or fully recessed above the plane of the ceiling. For concealed sprinklers with the operating mechanism partially recessed, the cover plate is typically conical in shape. For those that are fully recessed, the cover plates are typically flat to the wall or ceiling. Because the operating mechanism responds quicker when using a conical-type cover, in residential applications less water is needed to control the fire, making the flow rates better than those concealed sprinklers using a flat cover.

The concealed cover plate has a fusing temperature equal to or less than the sprinkler. In fire situations, the cover plate falls away leaving the sprinkler portion of the assembly exposed. When the heat operating mechanism of the sprinkler reaches the fusing temperature, the sprinkler head opens and discharges water on the fire.

Concealed sprinklers are offered in pendent and horizontal sidewall styles, and their cover assemblies typically offer $^{1}/_{2}$" of adjustment. Concealed sprinklers with a push-on, thread-off cover offer additional installation flexibility by fitting flush to the ceiling or wall, even if the drops are not straight. This type of cover, also gives you added security as the cover fits snugly on the sprinkler – *no need to worry about falling covers!*

Concealed sprinklers are generally shipped with plastic protective caps, with finish cover assemblies provided separately. The plastic cap protects the sprinkler during the shipping and installation process. It also protects the sprinkler while the ceilings or walls are finished. Once this process is complete, the protective cap must be removed and the cover assembly installed.

WHERE ARE CONCEALED SPRINKLERS USED?

Concealed sprinklers are available for commercial or residential applications and, because of their appearance and cost, are considered the "high-end" in sprinkler installations. There are several types of concealed sprinklers available covering a wide variety of installations. The following chart shows many of the options available.

Commercial concealed sprinklers are available for ordinary and light hazard occupancies in standard and quick response. As a result of changes to recent editions of NFPA 13, quick response sprinklers are required for light hazard occupancies in those jurisdictions that have adopted these standards. Similar changes provide incentives for using quick response sprinklers in ordinary hazard occupancies as well.

This concealed sprinkler is only 2" in diameter

ever Looked So Good

Types of Concealed Sprinklers

Response Type	Orientation	Nominal K-factor	Range of Sprinkler Temperature Ratings (F/C)
Commercial Standard Coverage			
Standard	Pendent	2.8	135/57 – 212/100
		4.2	135/57 – 212/100
		5.6	135/57 – 220/104
		8.0	135/57 – 200/93
Quick	Pendent	2.8	135/57 – 200/93
		4.2	135/57 – 200/93
		5.6	135/57 – 220/104
		8.0	135/57 – 220/104
Standard	Hor. Sidewall	5.6	165/74
Commercial Extended Coverage			
Standard	Pendent	5.6	165/74 – 220/104
		8.0	165/74 – 220/104
		11.2	160/71 – 212/100
Quick	Pendent	5.6	135/57 – 200/93
		8.0	135/57 – 200/93
		11.2	160/71 – 212/100
Quick	Hor. Sidewall	5.6	135/57 – 175/79
		8.0	135/57 – 175/79
Commercial Dry Standard Coverage			
Standard	Pendent	5.6	135/57 – 286/141
		8.0	135/57 – 286/141
Quick	Pendent	5.6	135/57 – 286/141
		8.0	135/57 – 286/141
Residential			
Fast	Pendent	3.5	155/68
		3.9	155/68
		4.1/4.2/4.3	140/60 – 160/71
		5.5/5.6	135/57 – 155/68

Concealed Horizontal Sidewall sprinklers are ideal for student housing retrofit applications

Consequently, quick response sprinklers have become the most popular. Hotels, office buildings, and other applications where a clean look is preferred are all excellent applications for concealed sprinklers.

With the recent legislation in some of the United States mandating sprinklers in student housing, concealed sprinklers have found another popular application. The flat-plate version can be painted any color to blend into the wall or ceiling of any dormitory room. And, with a horizontal sidewall option, retrofit jobs are easier to design and install. In addition to being unobtrusive, concealed sprinklers are also designed so that it is difficult to hang articles from the sprinkler, unlike many frame-style heads. This helps keep the sprinkler in good working order and minimizes the possibility of an accidental activation. These advantages make concealed heads an excellent choice in any area where mechanical damage is a concern.

Concealed sprinklers are often used in residential applications because of their aesthetic qualities. Multiple finishes and colors are available and provide the ability to blend into any décor. Those sprinklers utilising a flat cover plate also provide added protection against possible mechanical damage, by having the heat operating mechanism recessed into the ceiling.

Dry concealed sprinklers are commonly used in freezers and parking garages. Because the sprinkler is recessed into the ceiling, they are less susceptible to accidental damage due to forklifts or luggage racks of cars.

SPECIAL CONCEALED SPRINKLER CONSIDERATIONS

There are potential problems with concealed sprinklers, as with any sprinkler, if they are not properly installed. If the sprinkler is recessed too far into the wall or ceiling, the spray pattern can be impaired and effectiveness can be minimised. In addition, the ceiling plate may not be properly installed onto the sprinkler and may become disengaged.

Most quick response concealed sprinklers rely on vent holes to allow airflow to pass through the sprinkler assembly, thus allowing the sprinkler to operate more quickly. Without the vents, or if the vents become plugged, the operation time of the sprinkler is impaired.

Per NFPA 13, “Ornamental finishes shall not be applied to sprinklers by anyone other than the sprinkler


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not the Protection
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Among the tests performed at Underwriters Laboratories (UL) are sensitivity, distribution and fire tests.

Concealed sprinklers come in a variety of finishes and colors to match any décor

manufacturer, and only sprinklers listed with such finishes shall be used." If painted otherwise, the sensitivity could be inhibited, negatively affecting the performance in a fire situation. Painting concealed plates in place can also cause the plates to adhere to the ceiling so that they cannot drop away as required in a fire.

STRINGENT TESTING MANDATORY

There are many tests that *all* sprinklers are subjected to before receiving their listings and/or approvals. Among the tests performed at Underwriters Laboratories (UL) are sensitivity, distribution and fire tests. The sensitivity test measures the response time. To be considered quick response for UL Listing, the sprinkler must operate in 75 seconds or less in a controlled testing environment. Frame-style and flush quick response sprinklers generally operate more quickly than concealed sprinklers, which operate towards the higher end of the 75-second limit. A minimal increase in response time between exposed and concealed sprinklers can also be seen in standard response sprinklers.

The distribution test measures the effectiveness of the coverage of the water discharged from the sprinkler. During the distribution test, a minimum amount of water is required in each of sixteen pans laid out in a 4 x 4 array centered between 4 sprinklers at 10′ x 10′ spacing. An additional requirement for residential sprinklers measures their wall-wetting ability. The wall-wetting requirement is important as it envelops the fire, thus preventing the fire from spreading, while reducing the temperature of the room.

The commercial sprinkler fire test is another controlled test, where a 350-pound crib is burned with 1 gallon per minute of heptane. The sprinklers must maintain a temperature below the control temperature for 30 minutes. The control temperature equals the room's ambient temperature plus 530°F.

Fire tests for residential sprinklers utilize a small wooden crib and smaller amounts of heptane, in addition to several combustible materials to simulate furniture and paneling. During this test, the temperature is monitored in five locations to confirm that the compartment is "survivable." In addition, a third sprinkler used to simulate sprinklers in adjacent compartments, is not allowed to operate.

Additional tests performed include corrosion, operational, water hammer, leakage, hydrostatic, strength and vibration. Factory Mutual (FM) and Loss Prevention Certification Board (LPCB) have similar testing requirements for concealed and exposed sprinklers.

THE MOST ATTRACTIVE FIRE PROTECTION AVAILABLE

Concealed sprinklers, like all sprinklers, must pass a battery of tests in order to be listed or approved. Though concealed sprinkler response times tend to be higher than exposed sprinklers, the difference is negligible when put in an actual fire situation. And, generally, there is no difference between the performance of concealed and exposed sprinklers in many of the remaining tests.

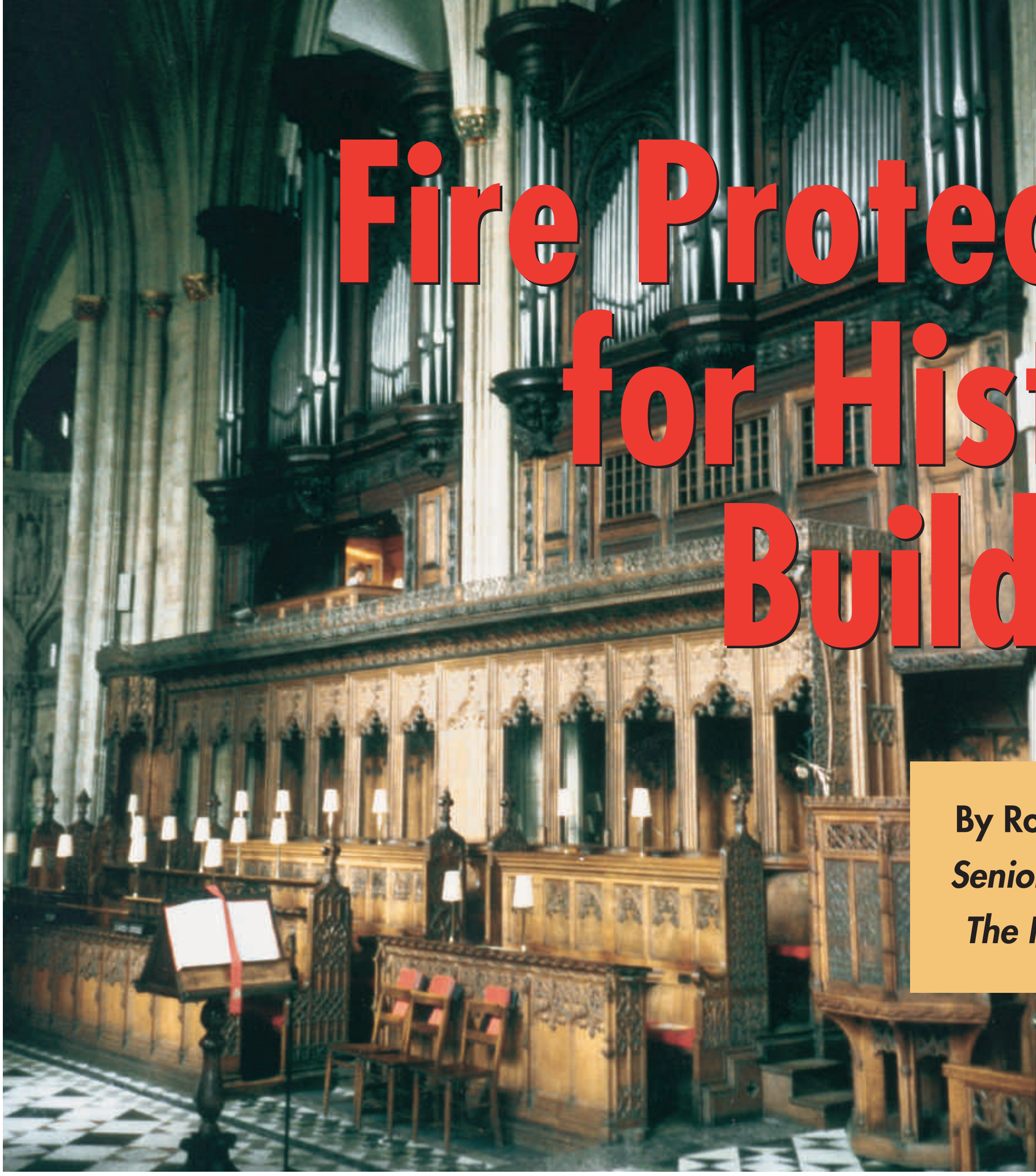
Concealed sprinklers with flat cover plates have low-profile appearance

Though improper installation may impair the spray pattern of a concealed sprinkler and painting a concealed cover by anyone other than the manufacturer may negatively affect its performance, the same is true about frame-style and flush sprinklers as well.

Concealed sprinklers offer the benefits of a clean, unobtrusive installation with a low-profile design that minimizes the possibility of accidental mechanical damage. These aesthetic and functional features, combined with options for commercial and residential applications make concealed sprinklers the most attractive fire protection available.

This article is a collaborative effort between Scott Franson, Director of Sprinkler Research and Development and Sandi Wake, Marketing Manager of The Viking Corporation. Scott Franson has been in the fire sprinkler industry for 20 years. Before joining Viking in 1990, he worked at Underwriters Laboratories testing products for the sprinkler industry. Sandi Wake began her career at Viking in 1983 and has held various positions in customer service and marketing, including that of Product Manager.

For additional information on concealed sprinklers and other Viking products, visit Viking's web site at www.vikingcorp.com or call 800-968-9501 or 616-945-9501.



Fire Protection for Historic Buildings

By Robert Libby, P.E.,
Senior Vice President,
The RJA Group, Inc.

Pic: courtesy of Airsense Technology

RECOGNITION AND REHABILITATION OF HISTORIC BUILDINGS continues to increase throughout the world. Providing adequate fire protection and life safety, while maintaining the historic attributes of structures provides significant challenges for building owners and managers. Historic structures are especially susceptible to fire and fire related damage and offer unique challenges for life safety. The very features that define the historic attributes often present the greatest challenges to providing acceptable levels of fire and life safety.

Fire growth and spread in historic buildings is often amplified by several factors. These include increased ignition factors, combustible construction and building components, inadequate barriers, lack of detection and alarm, as well as lack of automatic extinguishing systems.

Often historic buildings are used to interpret buildings and life of a previous period. This increases the hazards due to use of open flame devices such as candles, oil lamps, stoves and fireplaces. Additional fire risk factors for historic buildings include faulty wiring and malfunctioning equipment. Many historic buildings contain out dated and non – code compliant wiring and mechanical systems. Often these systems were retrofitted long after the historic structures were built, which increases the risks due to difficult and improper installation. Of course, like all buildings, historic structures are susceptible to common sources of ignition such as arson, smoking and exposure to other buildings or burning vegetation as well.

Once a fire ignites, historic buildings are susceptible to rapid-fire growth because, unlike modern buildings, combustible components were often used, both as structural elements as well as decorative finishes including floors, wainscoting, and ornate moldings. Another factor in rapid-fire growth is the common use of vertical openings and lack of horizontal compartmentation. The lack of mechanical systems in the original structures, such as ventilation systems and people conveyance systems, led to enhanced use of vertical openings. As sometimes seen, large monumental open stairs are located at main entrances, and often throughout buildings, to promote and allow easy people movement. Worse yet are numerous improperly enclosed or hidden vertical shafts, which may have been used for chimneys or natural ventilation shafts for air movement. Of course fire stopping was also mostly

Fire Protection for Historic Buildings

nonexistent, and most historic buildings predate the evolution and use of fire detection and suppression systems. This lack of basic compartmentation, coupled with increased available fuel from structure and contents, and lack of early warning and suppression, spells disaster for fire growth and spread.

The preservation of historic structures must also compete with basic life safety aspects if the building is either normally occupied or open to visitation. Saving lives must always take precedence over building structure and contents. Life safety has challenges similar to fire safety. Means of egress are often inadequate compared to modern code requirements. Exits are likely to be unprotected, as well as beyond current acceptable travel distances for exit paths and dead end corridors. Additionally, exit signs and emergency lighting are also usually non-existent. Add these deficiencies to the inherent potential for rapid fire – growth and spread, and certainly life safety presents a formidable challenge for historic structures.

With these factors in mind, where is the best place to start when addressing historic structures? The key factors in the successful design and protection for historic buildings, contents and occupants starts with the integration of fire protection engineering with other disciplines and the goals of historic preservation. This includes architectural building attributes, structural fire resistance, and the use of detection and alarm systems, security systems, as well as suppression systems.

The building attributes and structural fire resistance are predetermined in historic structures. Therefore, the basis of the fire protection and life safety approach must incorporate these features. Maintaining the historic fabric and original design intent of the building should be the key determining factors in the approach. The designers must also clearly understand the goals of the historic preservationist responsible for the project. There are two opposing philosophies that may be used in determining the basis for any upgrades to the building. One theory, which applies to most historic buildings with archaic materials, strives to provide upgrades with as little damage to historic fabric (i.e. walls floors,

decorative features, etc.) as possible. For instance, it would be acceptable to add fire and life safety features, as long as these were not destructive to the original building components. The other theory for historic preservation would be to provide necessary fire and life safety upgrades, but restore the building to the original intended look of the structure.

Unfortunately, building regulations are primarily written for new construction. And although there is ample information regarding determining fire resistance of archaic materials, little guidance is provided for dealing with the inherent deficiencies as mentioned above. Therefore the designers must develop an approach for determining the deficiencies and how to mitigate those deficiencies with as little impact to the original design intent and structure as possible. The evaluation should start with a through review of the existing conditions, and determination of the deficiencies that need to be addressed. Many of the deficiencies can be addressable without damage or changes to the historic intent or fabric, while others will require innovative solutions.

For example, for one very historically significant project in Washington, DC, we performed a detailed egress analysis and developed an alternate plan to address egress within the constraints of the historical features of the building. The final plan included adding new stairs in locations that would not impact the historic envelope of the building, and minimize destruction of historic fabric. We were able to develop

Pic: courtesy of RJA Group Inc

Pic: courtesy of Airsense Technology

horizontal exits within the building, which took advantage of the new stairs, minimized altering the interior historic spaces and allowed maintaining the eight open monumental stairs, which were a key element of the historical attributes of the building.

Without prescriptive codes for historic buildings, an important factor impacting the fire protection analysis is the emergence of performance-based codes and standards. We view performance-based design as a way of not only applying engineering techniques to unique design challenges, such as those in historic structures, but also as a way of reducing costs. This new approach to fire protection also demands that everyone involved in fire protection, authorities having jurisdiction (AHJ's), building owners and managers, fire departments and fire protection engineers, work closer together.

Performance based design concepts offer the greatest advancement and future enhancements in code regulation and building design. Although the United States has only recently begun developing performance based design fire safety regulations, the research and engineering communities have been developing tools and methodologies over the last 25 years to be used in performance based designs. As opposed to prescriptive code requirements, performance based design options establish goals based on acceptable levels of fire and life safety risk.

Performance-based design isn't a new concept. So-called "equivalent" solutions have been routinely developed and presented for approval on large, complex and historic building designs for years. For the fire protection engineer and the AHJ to evaluate the performance-based solution, there must be a mutual understanding and acceptance of the method of analysis. This is the key to credible performance-based design in the fire and building communities, and the fire protection engineer is the bridge to completing this important task.

> *Performance based design concepts offer the greatest advancement and future enhancements in code regulation and building design*

The use of performance methods will ultimately lead to building designs that reduce the probability for injury and loss of life to occupants, reduce the losses due to fire, reduce business interruption and reduce cost of construction and maintenance of buildings. Additionally, performance based design will allow greater flexibility in design, which will meet the future needs of a demanding, progressive end user.

As an example, advancements in fire behavior modeling allow the engineers to analyze fire growth and therefore tenability of the space for occupants. Coupling this technology with egress models allows the designer to evaluate exit placement and people movement. This same information and analysis technique could be used in areas where secure environments exist and movement of the public is hampered.

As building owners and facility managers search for more cost-effective approaches to fire protection, the desire for efficiency dictates a shift from traditional occupancy-type analysis to risk and hazard analysis. A major key to success is working with the project team to establish the scientific and engineering basis necessary for a complete building performance-based fire safety system that accounts for the design and use of the building.

As part of the building analysis, the fire protection engineer needs to evaluate possible uses of state of the art technologies for incorporation into the design. This would include uses of detection technology such as air sampling and beam detection. These can be used in areas where detectors are not desirable due to aesthetics.

Another new technology to consider is water mist suppression. Water mist systems utilize considerably less water than conventional sprinkler systems,

therefore allowing smaller piping. This may help in installing piping in historic areas, as well as allow protection to structures in areas with limited water supply.

As an example of system design concepts, for the same building mentioned above, we also prepared design documents to incorporate automatic sprinklers and voice evacuation speakers throughout the buildings. This included a detailed analysis of the historic features to study alternative suppression techniques, including water mist. Our goal of course was to minimize disruptions of the fabric and provide a system that was consistent with the historic elements. As such, we worked closely with the historic design architect, as well as the building historian to develop a system. The final design included copper pipe in many areas and the development of a special hanger to allow pipe runs in less historic spaces that minimized disruption of fabric while not altering the look of the spaces. Special consideration of the highly historic areas meant providing the sprinklers in rosettes and other architectural features that minimized drilling and produced a look that was less disrupting to the overall finish.

Success is achieved when the historic building maintains its original design and function and serves as a safe environment for the intended use and purpose

The advancements of fire protection engineering have been significant over the last twenty years, and although it may be somewhat hard to predict the exact state of fire protection and life safety twenty years from now, it is safe to assume that technology will continue to evolve. Advancements will continue to occur in computer modeling, performance based design, fire detection and alarm, fire suppression, and integration with the goals and applications of protecting historic structures and occupants who use them. Success is achieved when the historic building maintains its original design and function and serves as a safe environment for the intended use and purpose.

Mr. Robert J. Libby, P.E. is Senior Vice President of The RJA Group, Inc., a global consulting firm specializing in fire protection and security engineering. Mr. Libby has over twenty years of experience in the design of fire protection and life safety systems. He is a graduate of the University of Maryland's Fire Protection Engineering Program. To learn more about The RJA Group, visit their website at www.rjagroup.com.

Pic: courtesy of RJA Group Inc

FSSA news

Technical Committee Meets in June

FSSA's Technical Committee met for two days in June and reported on the following projects.

Pipe Design Handbook: The committee is working on Section 6 of FSSA's *Pipe Design Handbook for use with Special Hazards Fire Suppression Systems*. Section 6 covers supports and hangers. The committee expects to have a draft ready for review shortly.

This publication is the most comprehensive piping handbook in the industry for use with special hazards fire suppression systems. It provides guidance for conditions not specified in NFPA standards.

The handbook is currently available on the FSSA web site. Anyone who orders the publication now will receive a free update once Section 6 becomes available.

CO_2 Rate By Volume Calculations: A subcommittee has been created to develop CO_2 rate by volume calculations that will provide guidelines to the industry where none currently exist. The document will include both design concepts and examples. When complete, it will be presented to the NFPA 12 committee to be considered as part of the standard.

Test Guide for Recertification of Fire Suppression Cylinders: The committee is updating this document, originally published in the mid-90s. An initial draft should be available by October.

Pipe Fitting Requirements for Clean Agent Systems: The committee will finish this document by September and hopes to have it included in the next version of NFPA 2001.

Annual Meeting

FSSA's Program Committee is currently working on the 2003 Annual Meeting. The committee has been working diligently in response to feedback from FSSA members and is very close to finalizing the agenda and program content.

In FSSA's 2002 membership survey, respondents identified the annual meeting as a very important FSSA program. Ray and his group are working hard on the program so attendance will be well worth your while.

The meeting is scheduled for February 4-8, 2003 at the Sheraton Wild Horse Pass in Phoenix, Ariz. Program details will be available soon.

SHAPE

FSSA's public relations initiative, SHAPE (short for Special Hazards Awareness, Promotion and Education) continues to move forward. FSSA made a clean agent presentation at NFPA's recent World Fire Safety Conference. A panel of FSSA members detailed the features and benefits of clean agents and answered questions from the NFPA crowd.

Another SHAPE presentation was made in July at NFPA's Americas' Fire Expo. Bill Eckholm covered the features and benefits of clean agents for this international gathering.

FSSA continues to place both features and news articles in international publications to increase awareness of special hazards suppression systems. Our web site, www.fssa.net, reached an all-time high for traffic last month with 7,000 visitors. We were averaging 800 visitors a month prior to the SHAPE program.

Technical Training Seminar

FSSA's 2003 Technical Training Seminar is scheduled for November 8-9, 2002 at the St. Louis Airport Hilton in St. Louis, Mo. Details are available on FSSA's web site.

Educational Foundation

FSSA's Educational Foundation will be giving two scholarships away this year. Jessica Hubert and Matthew Keck will be receiving $3,000 and $1,000 respectively to help pay for their fire protection educations. The **FSSA Educational Foundation** awards scholarships annually to talented and worthy young people within the fire suppression industry.

Membership On the Rise

FSSA's Membership Committee has been very active. They have a goal of enrolling 20 new members prior to our annual meeting in February. To date, they have achieved 25 percent of that goal so far, signing up five new members since the last annual meeting.

Master Format

FSSA representatives will be working with the Construction Specifications Institute to develop new divisions of the CSI's Master Format. Specifically, they are working on developing new divisions 21 and 25. Division 21 will pertain to life safety/facility protection and Division 25 will pertain to communications.

The European 'Juggernaut' Approaches

Glasgow Science Museum
Pic: courtesy of Nullifire Ltd

PHIL CREWE, a consultant at Warrington Fire Research, evaluates the progress and momentum of the 'juggernaut' that is pan-European product approval with respect to materials used in the fire protection of structural steel.

When confronted with new standards and methods for determining product performance, particularly if they have a scent of Europe about them, manufacturers are often reticent to adopt new concepts and take a rather cautious approach, assuming that time is on their side.So when the largely slow moving 'juggernaut' that is pan-European product approval starts to accelerate towards them, manufacturers generally run for cover in the hope that they can hide behind their own national requirements rather than taking a more positive step forward towards them.

However, the 'juggernaut' is indeed moving more quickly than might be anticipated and in recent years so it is important that manufacturers make themselves aware of the requirements imposed by the European procedures and the benefits that they might bring.

The most well defined route for products to be placed in the European market, including those for the fire protection of structural steel, is likely to be that of CE marking.

THE BARE ESSENTIALS

One of the main aims of the European Union is to permit free trade between member states. For construction products this is facilitated by the Construction Products Directive (CPD), which identifies six key areas termed 'essential requirements'. These are:

1. **Mechanical resistance and stability.**
2. **Safety in case of fire.**
3. **Hygiene, health and the environment.**
4. **Safety in use.**
5. **Protection against noise.**
6. **Energy, economy and heat retention.**

Some, not necessarily all, are applicable to any construction product and the second essential requirement 'safety in case of fire' is of major importance to those concerned with provision of products offering a fire safety performance.

The above list of essential requirements shows that the European approach addresses the performance of the product not only in fire safety terms but also in relation to its everyday use i.e. it is fit for its intended purpose. Even in member states where CE marking may not be mandatory the essential requirements will still need to be addressed if a product is to be placed within that state or the European market as a whole. Consequently, the prime motivation in gaining pan-European acceptance is likely to be obtaining the CE mark.

In order to obtain a CE mark for a product it is necessary to fulfil a number of requirements that verify the product's performance.

PERFORMANCE VERIFICATION

The performance requirements for the product are set out in a Technical Specification that will identify which aspects of the essential requirements have to be met by different product groups. Where possible these Specifications are written as European Standards (ENs).

To support these Technical Specifications there are a host of other ENs detailing test methods, classification systems etc.

Some examples for fire protection are listed as follows:

EN 13501-1	Classification following reaction to fire tests
prEN 13501-2	Classification following resistance to fire tests
EN 1363-1	General requirements for fire resistance tests
EN 1365-3	Fire resistance tests for loadbearing elements-Part 3: Beams
EN 1365-4	Fire resistance tests for loadbearing elements-Part 4: Columns

Another document worthy of note is the ENV 13381-4. This is part of a series

Glasgow Science Museum
Pic: courtesy of Nullifire Ltd

of voluntary European standards that refer to test methods for determining the contribution to the fire resistance of structural members by applied protection. Part 4 is related to applied protection to steel members.

The reason for mentioning this particular document rather than emphasising the EN test standards referred to above for fire resistance testing is the way in which the performance of fire protection to steel is determined.

To conduct EN tests for every conceivable steel section size, shape, protection thickness and fire resistance classification period is both financially exhaustive and time consuming. Consequently, assessment techniques have been developed in Europe based on test data generated over many years. ENV 13381-4 is the current position with respect to the testing and assessment of applied protection to steel members. This document [p1]is a complete package rather than individual one-off fire tests covered in the ENs. and is also referred to in the classification standard prEN 13501-2.

The European document is in two main parts. The 'Fire Test' that specifies the tests required to provide information about the physical and thermal performance of the protection material and the 'Assessment' which prescribes how the data from the fire test is analysed.

Consequently, it is more likely that this document will form the basis of fire tests and assessments for Product Specifications related to steel protection.

ETAGS – AS A BASIS FOR PRODUCT APPROVAL

If it is not possible to draft an EN for a particular product then a different type of Technical Specification is prepared within the framework of the European Organisation for Technical Approvals (EOTA).

Approved Bodies within the member states issue European Technical Approvals (ETAs) against guidelines prepared by EOTA working groups. These are referred to as ETAGs.

With respect to products for the protection of structural steel a number of ETAGs are under preparation. These draft documents are listed as follows:

1. **ETAG No 000 Part 2:** Reactive coatings.
2. **ETAG No 000 Part 3:** Renderings (passive coatings) and kits based on renderings.
3. **ETAG No 000 Part 4:** Boards or slabs and kits based on boards or slabs.

ETAG No 000 Part 1 gives general guidance and all ETAGs will address the essential requirements.

The manufacturer is responsible for ensuring that the product complies with the necessary Technical Specification.

DEMONSTRATION OF COMPLIANCE – AKA – ATTESTATION OF CONFORMITY

The route a manufacturer must/may take to demonstrate compliance is known as Attestation of Conformity (AoC).; it is dependent upon:

- the importance of the part played by the product relating to health and safety
- the nature of the product
- the effect of the variability of the product's characteristics on its serviceability
- the susceptibility to defects in the product manufacture

The CPD identifies a range of systems for attestating conformity. These systems include details of all the participants with their respective roles and tasks. They range from System 1+, being the most onerous, to System 4, the least onerous. Most products with a fire performance will be in Systems 1 or 3, some in 2+. There are none in System 1+ category.

The system of attestation for each product is stated in the Technical Specification (annex Z of a harmonised EN and clause 8 of an ETAG). A system of attestation is given for each essential requirement, but in the case of 'fire safety' this is split into 3 'essential characteristics'.

- to fire
- fire resistance
- external exposure (to roofs)

and different systems of attestation can be given for each 'characteristic'.

A manufacturer, taking into account the end use application, has to first select which essential requirements/characteristics are relevant. The system of attestation for the product is then based upon or determined by the highest system for an individual characteristic.

This in turn governs the need to approach a Notified Body (NB) to process the Attestation of Conformity. The following table shows conformity systems and the various tasks that must be undertaken and who is responsibility the completion of the task – the manufacturer or the Notified Body.

A Notified Body (NB) will be a

- Test laboratory (System 3) or
- Inspection body (System 2 & 2+) or
- Certification body (System 1)

The current drafts of the previously mentioned ETAGs consider products for fire protecting structural steel against fire to be System 1 level of attestation i.e. these products will have to be the subject of independent third party verification provided by a Notified Body such as Warrington Certification Limited.

It should be noted that the manufacture of such products will need to be scrutinised by the Notified Body by an initial inspection of the factory and the factory production control at each site the product is produced.

A vital consequence of the requirement for type testing given in the Product Specification will be the need for the Notified Body to be involved in the selection of the product for these tests. Without the involvement of the Notified body the test data generated cannot be used

Attestation of Conformity Systems

System	Task for manufacturer	Task for notified body
4	• Initial type testing of product • Factory production control	None
3	• Factory production control	• Initial type of testing of product
2	• Initial type of testing of product • Factory production control	Certification of factory production control on basis of initial inspection • Initial inspection
2+	• Initial type testing of product • Factory production control • Testing of samples according to prescribed test plan	Certification of factory production control on basis of • Initial inspection • Continuous surveillance, assessment and approval of production control
1	• Factory production control • Further testing of samples according to prescribed test plan	Certification of product conformity on basis of tasks of the notified body and the tasks assigned to the manufacturer Tasks for notified body: • Initial type-testing of the product • Initial inspection of factory and of factory production control • Continuous surveillance, assessment and approval of factory production control
1+	• Factory production control • Further testing of samples according to prescribed test plan	Certification of product conformity on basis of tasks of the notified body and the tasks assigned to the manufacturer Tasks for notified body: • Initial type-testing of the product • Initial inspection of factory and of factory production control • Continuous surveillance, assessment and approval of factory production control • Audit testing of samples taken at the factory.

to demonstrate product compliance. Is important that the manufacturer works closely with their chosen Notified body to ensure the product is effectively placed on the European market with minimum complexity.

Once the ETAG is finalised the EC sets a date when the manufacturer can begin to place the CE mark on the product, this is usually 9 months later and is known as the Date of Applicability.

THE 'JUGGERNAUT' APPROACHES

When a Technical Specification is completed, a fixed time period is then given, usually 1 to 2 years, known as the 'Period of Co-existence'. During this period CE marking is optional and the manufacturer may demonstrate product performance by the existing national route or by the European route.

However, after this time period a manufacturer wishing to place a product on the European market must CE Mark the product and cannot use the existing national route to demonstrate product compliance.

Consequently, anyone failing to CE Mark a product after this time will not be allowed, under European law, to place the product on the European market.

CUAP – AN ALTERNATIVE ROUTE TO OBTAINING THE CE MARK

The development of Product Specifications is time consuming and involves wide consultation through a number of working groups etc, as a result the major ETAGs for steel protection are still in draft form and unlikely to be available [p2]for sometime to come?

Since it is not possible to CE mark unless a Product Specification is available a forward-looking manufacturer might consider an alternative approach to CE marking.

Under the auspices of clause 9.2 of the CPD it is possible for a manufacturer to obtain an ETA for a product in the absence of an ETAG and this is commonly referred to as a CUAP (Common Understanding of Assessment Procedures) approach.

Although a relevant draft ETAG is under development, it does not preclude the manufacturer from starting the CE marking process by adopting the CUAP procedure in advance of the ETAG being completed. In essence the CUAP procedure, when used in this way, will encompass the provisions on the final ETAG but allows the manufacturers to begin the process immediately.

The CUAP approach involves the manufacturer selecting an Approved Body (AB), such as Warrington Certification Limited, who will make the application for the CUAP on their behalf.

The application is made to the Technical Board (TB) of EOTA who may add additional input e.g. regulatory requirements and then submits the application to the EC who refers it to CEN. The application then follows a number of procedures that should result in agreement to proceed.

The chosen AB then prepares the CUAP. It is sent to all ABs for comments, which have to be made within two months. Once the comments are addressed and the CUAP endorsed (there should be no significant comments since the basis of the CUAP will be draft ETAG) the AB can start to assess the product in line with the CUAP.

It is envisaged that by the time the CUAP reaches this stage the ETAG will be formalised and therefore the product will be covered by the ETAG. The advantage to the manufacturer is that the process can be started in advance of the Technical Specification becoming available. The proactive manufacturer can hitch a ride on the 'juggernaut' rather than allowing it to pass them by or, even worse, run them over.

For further details contact
Phil Crewe at Warrington Fire Research Centre, Holmesfield Road, Warrington, Cheshire, WA1 2DS.
Tel: 01925 655116
Fax: 01925 646616
Email: phil.crewe@wfrc.co.uk.
Website: www.wfrc.co.uk

Fire Alarm System Cabling: "The Weak Link"

by Wayne D. Moore, P.E., FSFPE

AS THE INTERNATIONAL FIRE PROTECTION COMMUNITY advances toward performance-based fire alarm system design and applications, fire alarm system performance – its mission effectiveness during a fire – has come under increased scrutiny.

Fire alarm system mission effectiveness consists of four components:

- Design Reliability
- Equipment Reliability
- Installation Reliability
- Testing/Maintenance Reliability

Each of these reliability components must remain high in order for the mission effectiveness to achieve a high level. From qualitative and anecdotal surveys we have learned that two elements impact mission effectiveness most: installation and testing/maintenance.

The use of Cable that has a greater level of fire endurance and ensures connected equipment will still operate, offers one method to increase the reliability of the system. Fire Rated cable that has been tested to demonstrate its ability to carry an electrical load for a specified period of time when exposed to a fire is defined in the U.S National Electrical Code as "Circuit Integrity Cable".

CASE HISTORIES

Fire case histories make a strong case for requiring survivability of fire alarm system circuits. The London Apartment fire in Delaware, Ohio (USA) offers a case in point. On March 12, 1994, a fire occurred in an apartment building for the elderly in Delaware, Ohio.

The building fire alarm system consisted of manual fire alarm boxes and corridor smoke detectors. The installer had placed the wiring connecting these initiating devices to the fire alarm system control unit in surface-mounted metal raceway.

The fire reportedly started in a sofa located in a common area and spread to adjacent furniture. Fire investigators could not determine the cause of the fire. However, they believe that carelessly discarded smoking materials most likely ignited the sofa.

The smoke detectors located near the common area detected the fire, and actuated the fire alarm system. However, the fire quickly impinged on the metal raceway and damaged the fire alarm wiring inside. This damage ultimately silenced the audible fire alarm signal.

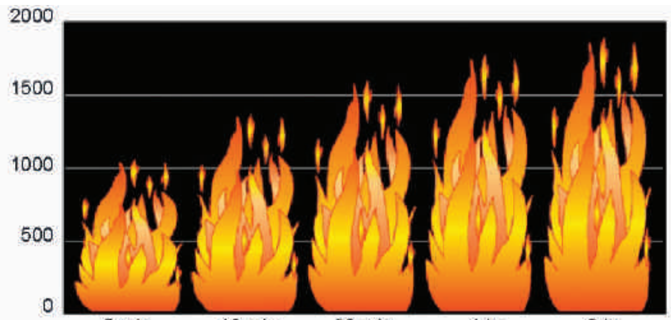
Because the fire alarm system notification appliances stopped operating shortly after they had first sounded the alarm, some residents believed a system malfunction had caused the alarm and they did not evacuate. By the time these residents realized an actual fire had initiated the alarm, the fire had sufficient time grow and block their exits.

Two residents died (one from smoke inhalation, one from a heart attack) and seven were injured. Had the fire alarm system wiring used cable that could withstand the fire attack, this needless loss of life would not have occurred.

Other U.S. fires with similar outcomes include:

- **November 26, 1978 – Holiday Inn Greece, NY**
  10 dead, 34 persons injured, 17 were firefighters
  The fire attacked the wiring in this 2-story building causing fire alarm system failure, a primary factor in the loss of lives.

- **January 21, 1979 Memphis, Tenn. Hospital**
  Damage estimated at $450,000
  The fire was discovered by a nurse at 8:30 P.M. and a manual pull station (call point) was immediately actuated, however the fire department was not notified until 8:54 by a passing motorist.
  The 24-minute delay in notification was attributed to the system wiring failure due to the fire.



Graphical fire size for standard time temperatre curve

The obvious question arises: "If the fire alarm system does not survive long enough during a fire to operate as required, then has the system met its mission effectiveness goal?"

ISSUES

Today's systems perform a multitude of functions after the detection of a fire. A fire alarm system typically will detect a fire, notify occupants and staff, and alert emergency services personnel. The system collects data and provides information that can help the fire fighting effort. But, because the wiring for the system connects within the protected premises and has no circuit integrity or fire protection "hardness", there is no assurance that the cabling will not fail. This failure will cause the alarm system to cease operation before it has performed its expected functions.

Other issues to consider include the mission effectiveness goal of fire alarm systems design. New technology allows more devices on a single circuit. Addressable analog circuits may have a hundred or more devices on one signaling line circuit (SLC).

This style of circuit design essentially puts "all of our eggs in one basket!" (Figure 1.) Consequently, a fire impacting on that circuit cable may take a large chunk (if not all) of the system out of service, just when we need the system the most. The use of "Class A" or a return loop, wiring configuration is sometimes used as an attempt to improve circuit performance reliability. However, most Codes do not require this wiring configuration and installing cable in this fashion will only allow the circuit to operate with a single open. The return loop configuration does not operate if it is shorted, a condition often caused by fire damage. Obviously this cable configuration may not address all designers concerns.

Fire alarm cable is the potential weak link in the chain of fire alarm system mission effectiveness. Fire alarm systems must typically function beyond the detection phase in order to meet the performance and mission effectiveness goals.

FIRE ALARM SYSTEM CABLING AND MISSION EFFECTIVENESS

To further assess the Mission Effectiveness of today's code complying fire alarm systems we must carefully understand what we expect the alarm system

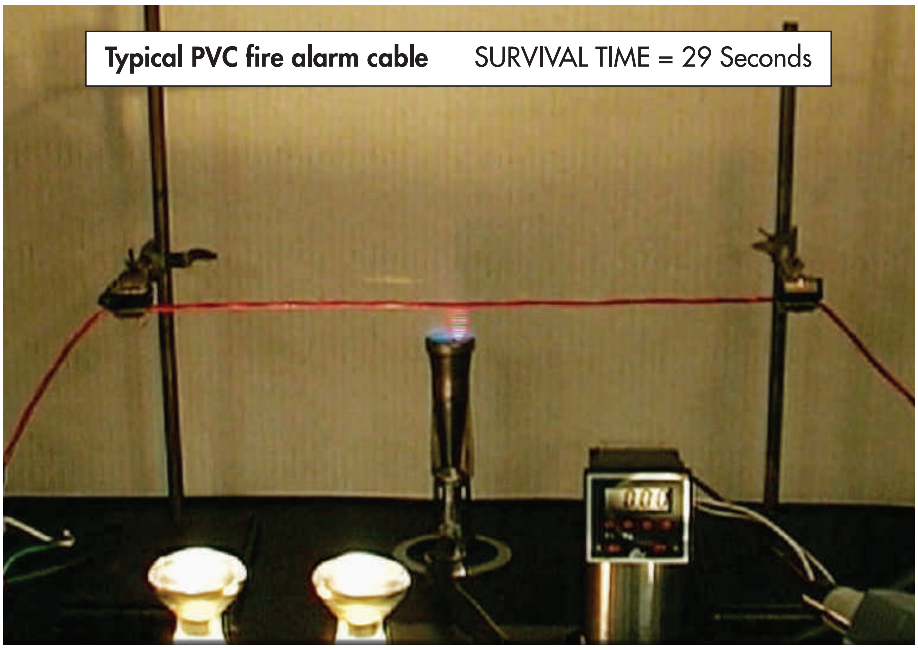
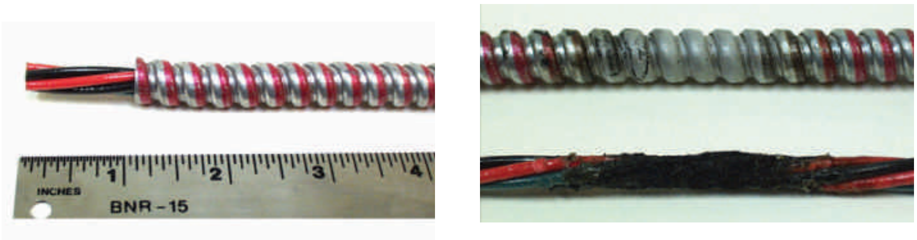


Figure 1. Small scale survivability testing of today's fire alarm cable – shown are some typical survival times of various cable configurations in small-scale fire tests

Interlocked Armor Fire Alarm Cable SURVIVAL TIME = 60 Seconds



to do, when we expect the alarm system to do it, and the reasonable performance expectation the fire alarm system will act as designed.

Because these circuits consisted of low voltage and low energy circuits installed in protected areas, the U.S. alarm and cable industry adapted minimum industry standards for fire alarm cabling. Since that time much work has been done to address the fire propagation and smoke off-gassing characteristics of fire alarm cables, but they still generally consist of low energy circuits installed in protected areas and are manufactured with minimum insulation and jacket thickness of thermoplastic materials.

The survivability of ordinary cables in fire conditions is usually limited. Figure 1 details the survival time of various types of cables when exposed to direct flaming conditions. When exposed to a direct flame a typical cable will be able to carry a load for less than one minute. In a structure with smoke detection throughout, initiation circuits may not be exposed to this condition prior to detection. However, signaling line circuits or initiating device circuits in buildings with a different form of detection could fail. Notification appliance circuits are also at risk in any fire.

CABLE TESTING

Countries throughout the world have developed test procedures to measure the fire endurance of cables and cable systems. The procedures include various protocols and are tested for many potential uses including fire alarm and fire pumps. Table 1briefly described the test protocols. The fire endurance rating assists a designer in determining if the cable performance provides an acceptable period for fire alarm operation.

Each country has additional criteria included in their tests, such as water-shock-impact tests. Britain uses water from a sprinkler head with the cable being hit against a metal plate. Belgium uses no water, but uses 2 impacts/minute shocks on the cable.

As a comparison to non-circuit integrity cables, the U.S. *National Electrical Code* (NFPA 70) references Underwriters Laboratories Inc. 2196,

Table 1 Test Protocols for Various Areas

Country Specification	Heat Source	Endurance Time	Temp. °C	Test Voltage (Cable Rating)	Failure Criteria
Britain BS-6387	Open Gas Flame	3 Hours	950	500 Volts @.25 amp (500 Volts)	3 amp fuse
Britain BS-7846	Open Gas Flame	3 Hours	950		
German DIN 4012 Part 12	Furnace (Oil)	30 Min/ 90 Min	830	110 Volts/400 Volts	2 amp fuse
Belgium NBN C 30-004	Open Gas Flame	3 Hours	900	600 Volts @ .25 amp	1 amp fuse
France NF C 32-070	Furnace (Small)	1 Hour	900	Rated Voltage	3 amp fuse
International IEC #331	Open Gas Flame	1.5 Hours	750	600 Volts @ .25 amp (600/1000 Volts)	2 amp fuse (was 3 amp)
Cenelec EN 50200	Open Gas Flame	1.5 Hours	830 +40	600 Volts @ .25 amp (600/1000 Volts)	2 amp fuse
Australia AS/NZS 3013	Furnace (Gas)	2 Hours	ISO Curve	240 Volts @ .25 amp (500 Volts)	4 amp fuse
United States UL 2196	Furnace (Gas)	2 Hours	ISO Curve	Rated Volts @ .25 amp (300/600 Volts)	3 amp fuse
Canada ULC/ORD C 854	Furnace (Gas)	2 Hours	ISO Curve	Rated Volts @ .25 amp (300/600 Volts)	3 amp fuse

"Standard for Tests of Fire Endurance Cables", as one United States standard for measuring circuit integrity. The test criteria for fire alarm cables consists of the following:

Samples of fire alarm cables are mounted on a large (10′ x 10′) wall and then exposed to a two-hour fire test followed by a hose stream test.

During the fire test and after the hose stream test the cables are energized with the proper utilization voltage, 1/4 to 1/2 amp current, a 3-amp fuse and a visual lamp.

The cables are water saturated with a low impact hose stream exposure.

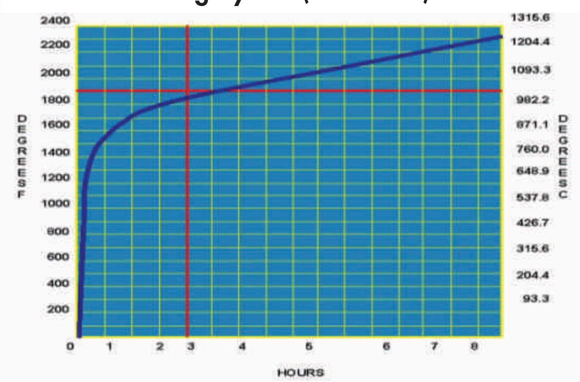
Acceptable circuit integrity performance of the cables is evidenced by the illumination of the lamp.

Conclusion: **"These requirements provide a relative measure of circuit integrity under specified fire exposure, hose stream and electrical conditions."**

CONCLUSION

If we expect fire alarm systems to perform reliably, they must perform during the adverse conditions of a fire. In order to meet that performance goal, the design must specify protection for the circuits in some fashion. The U. S. National Fire Alarm Code (NFPA 72) has moved in that direction and requires that, to ensure a voice alarm system will operate continuously during a fire, the installer must use a 2-hour fire rated fire alarm cable assembly or the cable must have a 2-hour fire rating for all speaker riser circuits. In addition, Australia, Britain, Belgium, Germany and Canada have developed versions of fire rated cable that is used in the wiring of fire alarm systems. Sadly, in all three of the case histories cited earlier the fire alarm systems did not provide voice evacuation and typically would not be required by NFPA 72 to use a 2-hour fire rated cable.

Standard time – temperature curve for circuit integrity test (two hours)



UL 2196 wall sliding into place over oven

The U.S. cable testing requirements provide a rigorous test of the ability of a cable to withstand fire conditions. Use of CI Cable provides a method to assist in assuring installation reliability. System designers now have options to ensure that a fire alarm system meets the desired performance goals. Circuit Integrity Cable in its many accepted forms may become an important element in all fire alarm systems if the systems are to meet the high expectations of mission effectiveness in fire alarm system designs.

Wayne D. Moore, P.E., FSFPE is a licensed professional fire protection engineer and the Director of Operations for the New England office for the fire protection engineering and code-consulting firm, Hughes Associates, Inc. He currently serves as Chairman of the National Fire Alarm Code Technical Correlating Committee, is Chairman of the Fire Detection Institute, and has served as a member of the NFPA Standards Council. He is a Fellow and Past President of the Society of Fire Protection Engineers. Mr. Moore has written numerous articles, is a Section Editor for the eighteenth edition of the *NFPA Fire Protection Handbook*, contributed to the NFPA *Fire Alarm Signaling Systems Handbook*, is the Editor of the 1993 edition and Co-Editor of the 1996 and 1999 editions of the *National Fire Alarm Code Handbook* ® and is co-editor of *the Moore-Wilson Signaling Report.*

COMPACT PUMPS FOR WATER MIST SYSTEMS

Nessie® radial piston pumps from Danfoss are often used for high pressure water mist systems because of their low weight, high efficiency and ability to generate uniform pressure without pressure peaks. Furthermore, these pumps are maintenance free in operation.

The pumps are available in 4 sizes and with displacements from 2cc/rev. to 80 cc/rev. (1.5 l/min to 135 l/min.) at pressures up to 160 bar.

Combined with nozzle inserts and the valve programme, a one-stop supplier of components for designing and building water mist systems, Danfoss is a preferred component supplier for high pressure water mist system builders around the world.

On request we can also deliver custom-made ready-to-use pump units.

Founded in 1933 in Denmark, Danfoss is today a truly global company with sales companies and representatives in more than 100 countries and 17000 employees.

For more information, please contact:
Danfoss A/S
Tel: +45 7488 3181
E-mail: waterhydraulics@danfoss.com

BEX EXPLOSION PROOF COMBINED SOUNDER AND BEACON

The latest additions to European Safety Systems' BEx family of explosion proof high output modular sounders and beacons for hazardous and heavy duty areas are the combined sounder and beacon units. A number of different options are available: 117dB(A) maximum output three-stage sounders, 15W loudspeakers or 110dB(A) Appello speech and tone sounders, all of which can be teamed with a 5 Joule Xenon beacon featuring a unique synchronised flash and available with a choice of six lens colours. The sounders have a 4MHz internal clock to ensure that all sounders on the same loop remain in synchronisation. The sounders have 32 different tones, including, for offshore use, the PFEER/UKOOA "General Alarm", "Toxic Gas Alarm" and "Prepare to Abandon Platform" tones, as well as all commonly-used European tones. A twin beacon unit, capable of synchronised or 'flip-flop' flashing, is also available.

The new combined units offer a considerable cost saving compared with the separate cost of an individual sounder and beacon; they also ensure that the audible signal is automatically reinforced with a visual warning. The sounder and beacon can be activated simultaneously or separately as required.

The EEx d rated units are ATEX/KEMA/CENELEC Certified, suitable for Zone 1 and 2, Gas Group IIB. A major benefit of the entire BEx family is the large termination area that accepts either one 4mm^2 or two 2.5mm^2 cables to make installation a very much easier process.

For more information, please contact:
European Safety Systems Limited
Tel: + 44 (0)208 743 8880
Website: www.e-2-s.com

BEAM DETECTORS PROTECT BRITISH MUSEUM'S GREAT COURT

Europe's largest enclosed public space, the Great Court of the British Museum in London, is protected against fire by optical beam smoke detectors from Fire Fighting Enterprises. Beneath a spectacular glazed canopy, the enclosure is criss-crossed by a network of beams from 24 of the company's Fireray 2000 detectors.

Europe's largest enclosed public space, the Great Court of the British Museum in London, is protected against fire by optical beam smoke detectors from Fire Fighting Enterprises

Unlike beam detectors which incorporate the control electronics in the detector heads themselves, the Fireray 2000 units have a separate, wall-mounted controller. This allows status checking and sensitivity adjustment to be carried out from ground-floor level, a convenient feature which was a key reason for the specification of FFE's product in the Great Court.

Protecting both the glazed courtyard and the world-famous Reading Room at its centre, the beam detectors form part of a sophisticated detection and alarm system which includes voice evacuation, smoke curtains and powered ventilation. Commissioned and maintained by Honeywell ACS Service Solutions, the system is able to trigger 40 ventilation fans installed around the rim of the Reading Room which are also used to increase air movement on very hot summer days.

The £100 m refurbishment of the Great Court, which previously served as book storage space for the now relocated British Library, has increased the Museum's public floor space by 40%. As well as the Reading Room and the courtyard, the project includes new gallery space, a bookshop, a café, lecture theatres and seminar rooms.

For more information, please contact:
Fire Fighting Enterprises Limited
Tel: +44 (0) 1438 317216
Website: www.ffeuk.com

FLEXIBLE CALL POINT RANGE FROM FULLEON

Fire protection equipment manufacturers Fulleon are reporting a positive response to their range of CX Manual Call Points.

Designed to meet the requirements of pr EN54-11, the CX range features a clip-retained, tamperproof front cover which saves significant installation and commissioning time, as well as providing added security.

The CXA200 addressable version also allows the address board and address switches to be mounted behind the cover, ensuring minimum dismantling is necessary, with address setting achieved without the need to remove the call point back box from the wall.

Additional features include options of a glass or re-settable plastic element; a visual alarm flag to enable easy identification of a triggered call point; a light tube for improved LED visibility; an encapsulated circuit for enhanced environmental protection and a range of colour options to allow use in fire and non-fire applications (e.g. extinguisher release).

For OEMs (Original Equipment Manufacturers) there is also available a rear mount addressable option designed to incorporate existing addressable PCBs in the new call point, without the need for a redesign.

For more information, please contact:
Fulleon Ltd
Tel: +44(0)1633 872 131
Website: www.fulleon.co.uk

LPG'S ARGON FIXED FIRE-EXTINGUISING SYSTEM

The extinguishing agent used in LPG's Inert Gas systems is Argon, which is listed as IG-01 in NFPA 2001 & ISO 14520. As it is found in the atmosphere, it is readily available and easy to refill (unlike blended mixtures). The systems themselves are based on the principle of reducing the oxygen concentration in the protected area, thus suppressing fires by suffocation. They are ideally suited to protect computer rooms, telephone central exchanges or any other areas where electrical & electronic equipment is used.

LPG Argon fire-extinguishing systems offer the following advantages:

- Zero Ozone Depletion Potential
- Zero Global Warming Potential
- Safe for use in occupied areas
- Do not leave residues
- Do not form ice
- Low refill costs
- 200 bar & 300 bar systems

Cylinders of 140l are available, which save space, money and installation time.

The Argon system has been developed through a continuous R&D programme carried out in LPG's own testing laboratory (which includes combustion chambers). Both the required hardware and software have been developed in accordance with international standards, at present holding VdS and LPCB approvals.

For more information, please contact:
LPG Técnicas en Extinción de Incendios, S.A.
Tel: +34 93 480 2925
E-mail: marketing@lpg.es
Website: www.lpg.es

HI-FOG WATER MIST FIRE PROTECTION

The patented Marioff gas pump unit (GPU) has FM-approval

TESTED. APPROVED. PROVEN.

Marioff is the leading supplier and developer of water mist fire protection systems. Marioff's HI-FOG high-pressure, Class 1, water mist technology is based on rigorous full-scale fire testing, hundreds of patents and approvals by various authorities.

Due to the extensive amount of research and testing, Marioff has gained a superior knowledge, understanding and experience on water mist fire fighting in a wide range of applications. Every new application is still taken as a new challenge to overcome. This experience is well acknowledged and the company representatives actively take part in the work of different standardisation bodies' worldwide.

HI-FOG water mist systems have been proven to be applicable to the widest range of different applications. Consequently HI-FOG has the largest collection of both marine and land approvals. The approvals are the best way – and sometimes the only way – to compare different water mist systems, their dimensioning criteria and drawbacks.

Still, there are not many standardised requirements for water mist systems. Factory Mutual Research (FM) has been very active in developing test procedures for a wide range of different applications. HI-FOG has now existing FM-approvals for following applications:

- Combustion Turbines and Machinery Spaces up to 260 m^3 and up to 500m^3
- Light Hazard Occupancies
- Wet Benches and Other Processing Equipment
- Computer Room Sub floors
- Fire tests are successfully completed up to 3300 m^3 volume for turbine enclosures and machinery spaces.

For more information, please contact:
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Tel: +358 (0)9 870 851
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EFFECTIVE FIRE SEALING FOR PLASTIC PIPES

1, 2002 The benefits of low weight and cost means the marine industry is increasing the use of plastic pipes for water, compressed air and hydraulic services. The downside of plastic is a threat of fire spread where services pass through bulkheads and decks. Roxtec, the acknowledged leader in the supply of cable and pipe transit systems, have developed a new system for the safe sealing of plastic pipes. Their plastic pipe seal (PPS) is suitable for plastic and PVC pipes from 16 mm to 110 mm diameter.

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The PPS system will appeal to boat builders and repairers because it is based on a familiar and proven technology that is simple to install and totally maintenance free. The PPS has been tested and approved to withstand four bar pressure for water and gas. It has also been subjected to a 60-minute fire integrity test in bulkheads and decks made from aluminium and steel.

Roxtec produce a complete range of entry seals for cable and pipe penetrations. The unique multi-diameter technology and adaptability allows for present and future needs. The entry seals protect against dust, water, fire, gas, pressure, vibration and electromagnetic interference. Roxtec has expertise in marine and offshore, telecom and industrial applications. A complete technical service is provided to designers, engineers and installers to enable the correct product to be specified.

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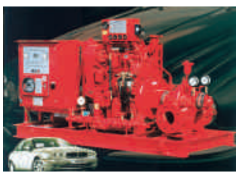

Sterling SPP fire protection pumps and associated equipment have been installed at Jaguar Cars' Halewood state of the art manufacturing plant, where the exciting and prestigious new Jaguar X-Type all wheel drive saloon car – otherwise known as the Baby Jag – has recently commenced production. These pumps were selected because they enable prompt, reliable and effective fire control, should this ever be needed, in the plant's vehicle trim and final assembly line, which is expected ultimately to process up to 100,000 vehicles a year.

The importance of this installation in such a high profile and high investment plant cannot be over-emphasised. In the event of a fire ever breaking out, relevant and top quality equipment would be in place to enable the rapid prevention of personal injuries and damage to manufacturing equipment. Thus, production disruption would be minimal with both jobs and revenue being protected.

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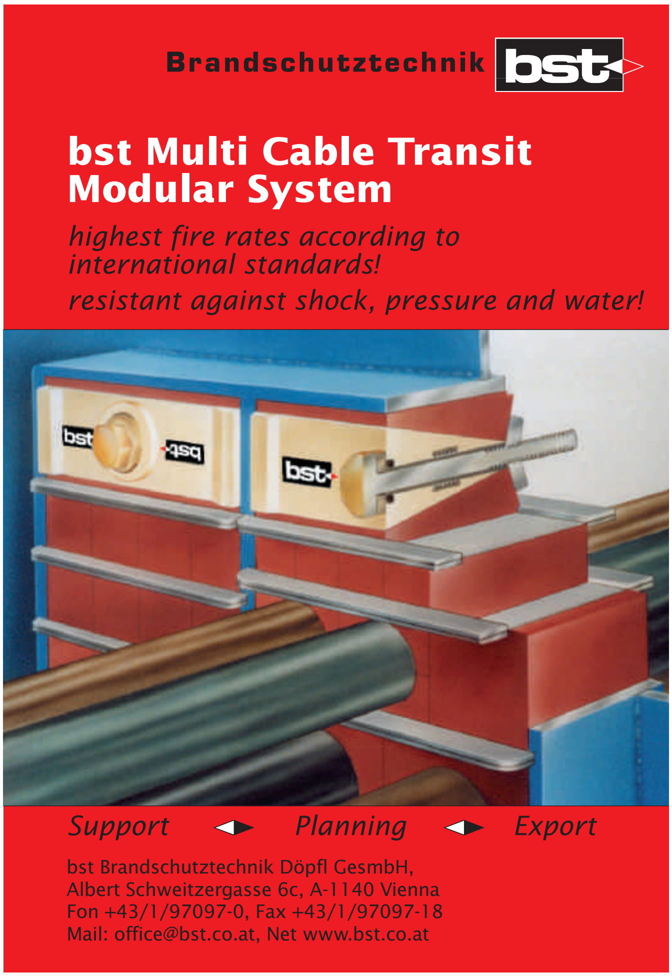

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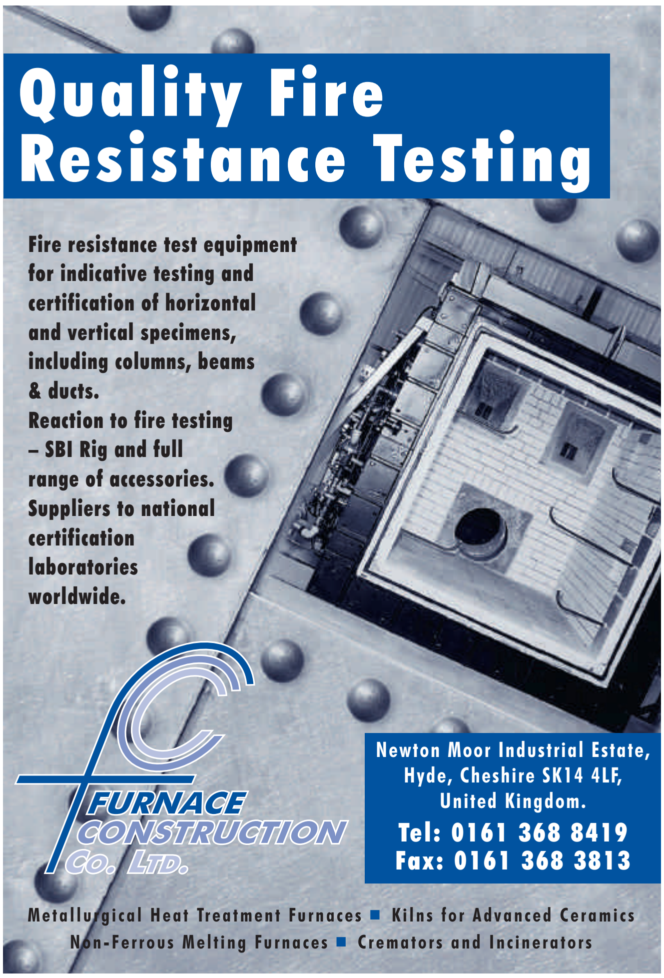

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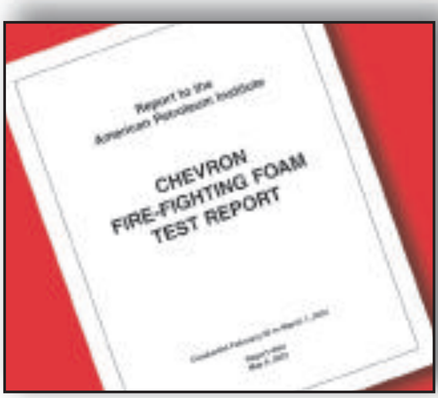

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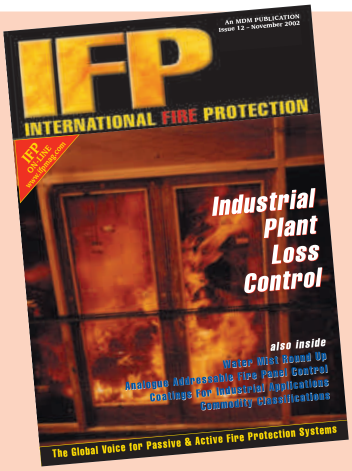

Front cover picture: Fire door testing
Picture courtesy of Chiltern International Fire

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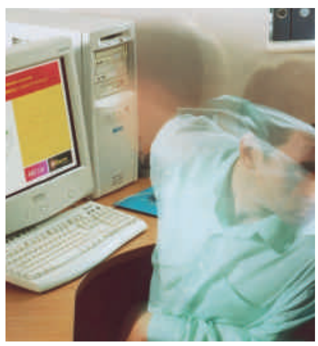

Commodity classification by fire-testing for properly designed sprinkler systems

By Magnus Arvidson, SP Swedish National Testing and Research Institute

The fire when tested at a water application rate of 10,0 mm/min.

The fire characteristics of stored commodities in a warehouse are an important parameter when determining the design and capacity of a sprinkler system. Unfortunately, this is a parameter that is often difficult to assess.

Fire-testing the type of commodity to be stored can provide considerably better information on its fire and suppressability characteristics than does a general examination. A Swedish research programme that has recently been concluded was aimed at establishing limits for the classification to be used in conjunction with the forthcoming European rules for sprinkler systems. The methodology, and its resulting classification limits, means that any particular type of commodity can be classified with considerably better accuracy and safety than by using simple assessment.

THE EUROPEAN COMMODITY CLASSIFICATION SCHEME

The European commodity classification scheme described in Annex B of the forthcoming European Standard, prEN 12845, "Fixed fire fighting systems, Automatic sprinkler systems, Design, installation and maintenance" [i], is based on an examination of the materials (the 'material factor') and the storage configuration of the commodity.

There are four main commodity categories – I, II, III and IV – where category I represents the least hazardous and category IV the most hazardous commodity. To categorise the commodity, the common method is first to examine the materials involved, in order to determine a material factor, and thereafter to determine its storage configuration. Some type of commodities may fall outside the classification scheme, and are denoted 'Special Hazards'. These commodities require sprinkler protection in excess of category IV commodities, and special protection requirements are given in Annex G of prEN 12845.

The material factor must take into account the product, the packaging material and the pallet material. The material factors and typical commodities are listed below:

Material factor 1 is defined as non-combustible products in combustible packaging and low or medium combustibility products in combustible or non-combustible packaging. The commodity is allowed to contain only modest amounts of plastics. The amount of unexpanded plastic or rubber content should be less than 5% (by weight), and the amount of expanded plastic or rubber content less than 5% (by volume). Examples include metal parts with or without cardboard packaging on wood pallets, leather products, wood products and canned food.

Material factor 2 corresponds to products with a higher energy content than material factor 1 products; for example, those containing greater quantities of plastics. Examples include wood or metal furniture with plastic seats, electrical equipment with plastic parts or packaging and synthetic fabrics.

Material factor 3 corresponds to products containing predominantly unexpanded plastic or materials with higher energy content. Examples include empty car batteries, plastic briefcases, personal computers and unexpanded plastic cups and cutlery.

Material factor 4 corresponds to products containing predominantly expanded plastic (more than 40% by volume) or materials with a similar energy content. Examples include foam mattresses, expanded polystyrene packaging and foam upholstery.

Figure 1. Annex B of prEN 12845 specifies that the material factor for a commodity that consists of mixtures of materials should be determined on the basis of the content of plastics, using this figure.

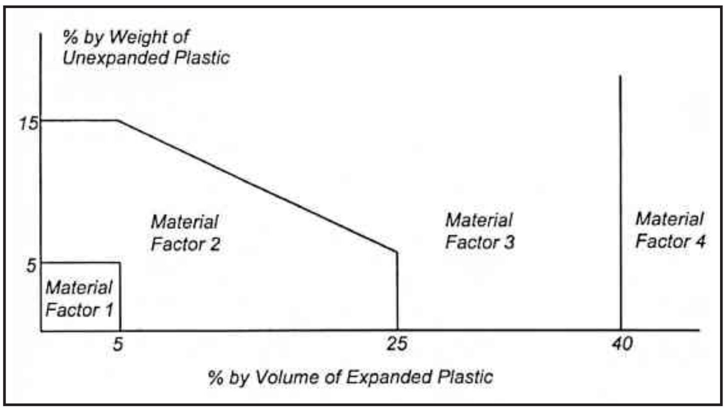

Figure 1 is used to determine the material factor when a commodity consists of mixtures of materials. The commodity shall be regarded as consisting of all packing and the material of the load pallet. Rubber should be treated in the same way as plastic.

After the material factor has been determined, the storage configuration must be evaluated using Table 1. Detailed descriptions of the storage configurations are given below the table.

The following descriptions of storage configurations shown above are given in Annex B of prEN 12845:

Exposed plastic containers with non-combustible content. Applies only to plastic containers containing liquids or solids in direct contact with the container, and does not apply to metal parts in plastic storage boxes. Examples include plastic bottles of soft drinks or liquids with less than 20% alcohol.

Exposed plastic surface – expanded. Exposed, expanded plastics are generally more severe than unexposed plastics and should be treated as Category IV.

Exposed plastic surface – unexpanded. The category should be increased to either III or IV when the commodity has exposed plastic surfaces comprising one or more sides or more than 25% of the surface area. Examples include metal parts in PVC storage bins or shrink-wrapped tinned foods.

Table 1. The influence of storage configuration on the classification of a commodity in accordance with Annex B of prEN 12845.

Storage configuration	Material factor			
	1	2	3	4
Exposed plastic container with non-combustible content	Cat. I, II, III	Cat. I, II, III	Cat. I, II, III	Cat. IV
Exposed plastic surface – expanded	Cat. IV	Cat. IV	Cat. IV	Cat. IV
Exposed plastic surface – unexpanded	Cat. III	Cat. III	Cat. III	Cat. IV
Open structure	Cat. II	Cat. II	Cat. III	Cat. IV
Solid block materials	Cat. I	Cat. I	Cat. II	Cat. IV
Granular or powdered material	Cat. I	Cat. II	Cat. II	Cat. IV
No special configuration	Cat. I	Cat. II	Cat. III	Cat. IV

Open structure. Commodities stored with, or having, a very open structure, generally present a higher hazard than materials with a closed structure. The high surface area together with high access of air encourages rapid combustion.

Solid block materials. Materials in solid block form usually have a low surface area to volume or mass ratio, which reduces the burning rate and permits a reduction in classification (however, not applicable to blocks of expanded plastics, which should be treated as Category IV.)

Granular or powdered materials. Granular or powdered materials that will spill out during a fire and tend to smother the fire will be less hazardous than their basic material counterparts.

No special configuration. Commodities that have none of the characteristics described above, e.g. cartoned commodities.

NINE TYPES OF COMMODITIES WERE TESTED

The aim of the research programme was to establishing limits for the classification to be used in conjunction with prEN 12845. The following nine types of commodities were tested in the research programme[2]:

- Triple, bi-wall corrugated cardboard cartons (denoted the EUR standard Class II commodity)
- Corrugated board cartons with interior dividers.
- Corrugated board cartons with 15% (by weight) of unexpanded plastic.
- The EUR standard plastic commodity (contains 42% (by weight) of unexpanded plastic).
- Plastic (HDPE) containers.
- Corrugated board cartons with 25% (by volume) of expanded plastic.
- Corrugated board cartons with 40% (by volume) of expanded plastic.
- Solid polystyrene blocks in corrugated board cartons.
- Piled wooden pallets.

The commodities were chosen such that they either fell clearly into one of the four commodity categories (I-IV) specified in prEN 12845, or such that the material factor was at the boundary between two different classes as indicated in the table above. In addition, two of the chosen commodities were considered as 'Special Hazards'.

All commodities were supported on slatted 1200 mm by 1000 mm wooden pallets during the tests.

THE FIRE TEST METHODOLOGY

Fire-testing involves arranging four pallet loads of the particular commodity in a rack segment. A water applicator consisting of a matrix of spray nozzles is arranged over the commodity and the whole set-up is positioned beneath a calorimeter in order that the heat release rate can be measured. The commodity is ignited at the centreline of the flue space, and water is applied when the fire reaches a predetermined convective heat release rate of 2 MW. At that point, the fire normally involves the whole upper tier of the commodity. Three such trials are conducted for each type of commodity, at three different rates of water application. However, in some of the cases, the first two extinguishing trials are followed by a third free-burning trial. The water application rates should be either 2,5, 5,0, 7,5 or 10,0 mm/min. The first test is always conducted at 5,0 mm/min and, depending on the results, a decision is made as to whether the water application rate should be increased or decreased. It should be noted that the water application rates used in the tests do not have any connection to the design densities used in prEN 12845.

The methodology was originally[3] developed by FMRC for classification according to the US commodity classification scheme, and has been used by SP for about ten years. However, because of the difference in size of European pallets and US pallets, the methodology has been modified, e.g. regarding the design of the water applicator. The amount of commodity used in each of the tests has also been reduced, from the eight pallet-loads that were originally specified, to only four pallet-loads. As three trials are then required for each type of commodity, the total quantity of commodity consumed is reduced from 24 to twelve pallet-loads.

TEST RESULTS

Although the test results showed significant differences in the fire hazard among the tested commodities, it can be concluded that most of the commodities (with a few exceptions) had a hazard level that corresponded to the commodity categories given in prEN 12845. With the data obtained from the tests, any commercial commodity could be tested and classified in accordance with the requirements of prEN 12845. Figure 2 shows the total heat release rate histories for a selection of tested commodities. The tests were conducted with a water application rate of 5,0 mm/min.

One of the commodities shown to have a hazard level in excess of its classification given in prEN 12845 is the EUR standard plastic commodity. According to prEN 12845, this commodity should be classified as a Category III commodity. However, the tests indicate that the fire characteristics are in excess of the corrugated board cartons with 40% (by volume) expanded plastic, and in fact similar to the tested solid polystyrene blocks in corrugated board cartons. This result highlights the difficulty of determining the fire characteristics of a given commodity using simple assessments, whereas a commodity classification based on fire-testing provide considerably better information.

EVALUATION OF THE TEST RESULTS

Based on the heat release rate measurements, the following quantitative figures are determined for each of the tests:

V1 – the maximum one-minute average convective heat release rate. About two-thirds of the energy generated by a fire is released through convection. Convection produces the velocities and the temperatures in the fire plume, and since the proportion of penetration of water droplets

Figure 2. The total heat release rate histories for a selection of tested commodities. The particular tests were conducted using a water application rate of 5,0 mm/min.

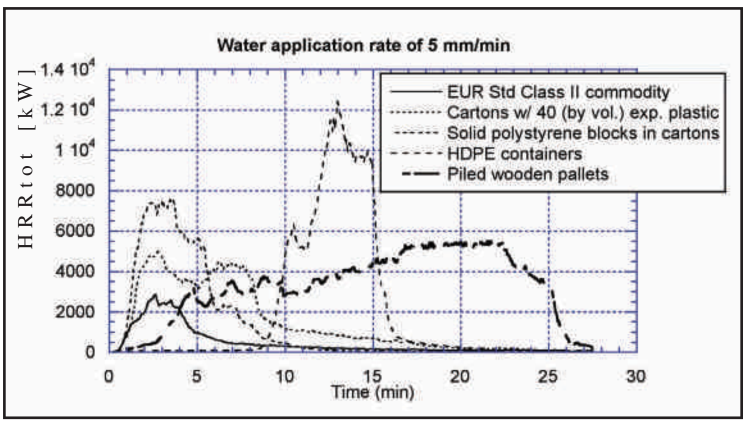

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Table 2. Classification of the commodities used in the test programme according to Annex B of prEN 12845.

Commodity	Judgment according to prEN 12845		Classification according to prEN 12845
	Material factor	**Storage configuration**	
Triple, bi-wall corrugated cardboard cartons (denoted the EUR standard Class II commodity)	1	Solid block materials	I
Corrugated board cartons with interior dividers	1	Open structure	II
Corrugated board cartons with 15% (by weight) of unexpanded plastic	Boundary between 2 and 3	Open structure	Boundary between II and III
Corrugated board cartons with 25% (by volume) of expanded plastic	Boundary between 2 and 3	Open structure	Boundary between II and III
The EUR standard plastic commodity (42% (by weight) of unexpanded plastic)	3	Open structure	III
Plastic (HDPE) containers	3	Exposed plastic surface – unexpanded	III*
Corrugated board cartons with 40% (by volume) of expanded plastic	Boundary between 3 and 4	Open structure	Boundary between III and IV
Solid polystyrene blocks in corrugated board cartons	4	Solid block materials	IV
Piled wooden pallets	1	Open structure	II**

*Polypropylene or polyethylene storage bins shall be protected in accordance with Annex G, "Protection of Special Hazards" of prEN 12845.
**Unused pallets shall be protected in accordance with Annex G, "Protection of Special Hazards" of prEN 12845.

from a sprinkler, which penetrates the fire plume, depends on the velocities and the temperatures, penetration depends on the convective heat release rate.

V2 – the maximum one-minute average total heat release rate. The total heat release rate includes the energy released both by convection and by radiation, as well as the heat being conducted away and absorbed within the storage array. The radiation component of the total heat release rate accounts for approximately one-third of the energy generated by a fire. Radiation is the primary mechanism by which fire spreads across aisles and other open spaces to adjacent combustibles. The total heat release rate is therefore a measure of the potential for fire spread as well as an overall fundamental measure of fire severity.

V3 – the convective heat release rate averaged over the most severe five-minute interval of the fire duration time. The energy convected upwards is largely responsible for the heating of exposed steel in the ceiling and the operation of automatic sprinklers. The maximum value of the convective heat release rate does help to characterize the severity of the fire. However, regarding the heat transfer, the duration time is as important as magnitude.

V4 – the convective energy generated during the most severe ten-minute interval of the fire duration time. This value is an important measures of a fire's maximum potential for causing thermal damage: the higher the convective energy, the greater the damage potential.

CLASSIFICATION CRITERIA PROPOSED

Figure 3 shows proposed classification criteria for Category I, II, III and IV commodities, as well as the limit for commodities that have so severe fire characteristics that they require special protection. Those that exceed Category IV, and which therefore require special fire protection measures, are classified as a 'Special Hazard'. It should be noted that Figure 3 refers only to the V1 parameter. Similar classification diagram have also been developed for the V2 – V4 parameters.

The methodology, and its resulting classification limits, means that any particular type of commodity can be classified with considerably better accuracy and safety than by using simple assessment in accordance with prEN 12845.

The research programme was sponsored by the Swedish Fire Research Board (Brandforsk).

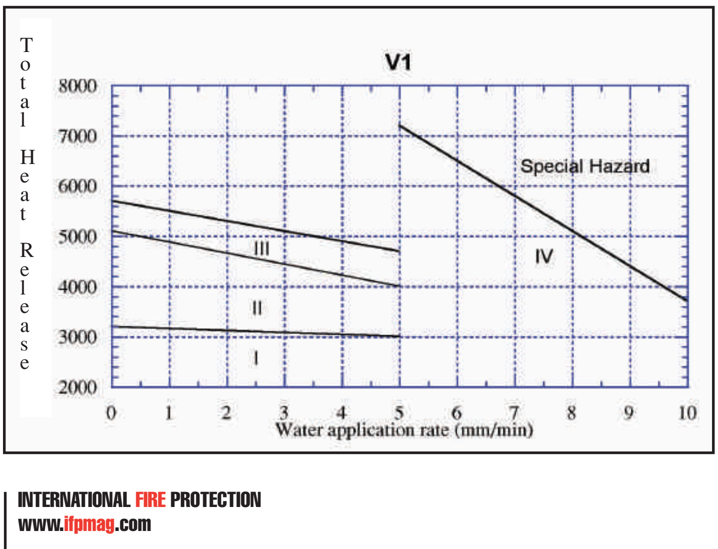


Figure 3. Classification limits for V1, the maximum one-minute average convective heat release rate. Similar classification diagram have also been developed for the V2 – V4 parameters.

[1] prEN 12845, "Fixed fire fighting systems, Automatic sprinkler systems, Design, installation and maintenance", Draft 25, December 31, 1999
[2] Arvidson, Magnus and Lönnermark, Anders, "Commodity Classification Tests of Selected Ordinary Combustible Products, Brandforsk Project 620-001", SP Report 2002:03, Swedish National Testing and Research Institute, Borås, 2002 (the report can be downloaded from www.sp.se)
[3] Chicarello, Peter, J. and Troup, Joan, M. A., "Fire Products Collector Test Procedure for Determining the Commodity Classification of Ordinary Combustible Products", Factory Mutual Research Corporation, August, 1990

Magnus Arvidson is a graduate Fire Protection Engineer from the University of Lund in Sweden. He has been working at the Department of Fire Technology at SP Swedish National Testing and Research Institute since 1991, mainly responsible for activities related to water mist and sprinkler system testing and research. He can be reached at telephone +46 33 16 56 90 or e-mail magnus.arvidson@sp.se

Halon System Removal in Europe

The Time For Action is Now

IN THE EUROPEAN UNION, the systematic phase-out of halon fire suppression systems began in October of 1990 with the enactment of Regulation EC 2037/2000. Halon fire extinguishing systems are installed throughout the world, protecting such valuable and irreplaceable assets as electrical and electronic equipment, communications and mission critical facilities, cultural property, vehicles and vessels, and many other important industrial fire protection applications.

Understanding the Law

The new halon regulation affects all owners of land- or sea-based fire suppression systems containing halon. It sets forth a staged approach to the ultimate removal of halon systems across the EC.

- Newly manufactured halon cannot be used to refill new or existing fire suppression systems effective 1 October, 2000.
- Recovered, reclaimed, or recycled halon cannot be used to refill existing fire suppression systems after 31 December 2002.
- All fixed and portable fire extinguishing systems containing halon that are not listed as critical must be decommissioned and removed from service by 31 December 2003. The halon must be processed for destruction or for recycling and reused by critical users.

Annex VII of EC 2037/2000 defines a limited number of "critical uses" acceptable for the placement of recycled halon. These are predominantly aerospace, defense, commercial marine, and petrochemical applications. A management committee representing the member states periodically reviews these uses. As viable alternatives become available, the committee may ultimately stop the use of halon in these applications.

Note that compliance with the European law is not limited solely to the removal of suppression system hardware: halon removed from decommissioned systems must also be destroyed by an environmentally acceptable technology. As the removal and destruction of halon will ultimately be at a cost to the system owner, there is a concern that these systems might be vented to the atmosphere rather than remediated by an acceptable destruction technology. The purposeful or otherwise illicit venting of halon to the atmosphere is strictly prohibited under Article 21 of EC 2037/2000, and would expose the system owner to substantial penalties under the laws of each EU member state.

All owners of decommissioned halon systems should insist on documentation from their decommissioning contractor certifying the destruction of their halon or placement into an approved critical use. The responsibility and proof of compliance with the law lie with the owner of the halon system.

HFC-227ea: Fire Protection and Environmental Stewardship

Replacing halon in fire protection systems has been occurring since the earliest days of the Montreal Protocol Treaty on Substances that Deplete the Ozone Layer. A number of suitable alternatives to halon have been commercially introduced and accepted by users. The most widely accepted alternative to halon worldwide has been heptafluoropropane, known more commonly as HFC-227ea.

Great Lakes Fire Safety began developing HFC-227ea in the late 1980s specifically as a replacement for Halon 1301 and introduced it commercially under the FM-200® brand name in 1992. Recognizing the unique benefits of this compound, Great Lakes dedicated extensive resources to the development of the FM-200® brand so that, over the years, it has become the world's most trusted choice in clean agent fire suppression. In 2001, DuPont Fluoroproducts introduced its own HFC-227ea product to the marketplace under its FE-227™ trademark, owing to the overwhelming global acceptance and future potential for this important product.

The tremendous commercial success of the FM-200® product over the past decade has established a sizable quantity of this extinguishing agent in the marketplace. Some FM-200® systems have reached the end of their service life. Some decommissioned systems are now finding their way into the traditional recycling channels established for halons.

"Recycling HFC-227ea and reselling it without authorization may pose several issues," according to Doug Register, Business Director for Great Lakes Fire Safety Products. "Once the extinguishing agent is removed from its original system container and separated from the nitrogen propellant, it ceases to be the product sold by Great Lakes or DuPont. HFC-227ea sold by producers other than Great Lakes or DuPont in countries where their patents are in force may constitute a patent infringement.

Recycled HFC-227ea is not subject to the quality control of Great Lakes or DuPont. Any recycled or reprocessed product sold or otherwise represented as the original extinguishing agent, such as FM-200®, without a license constitutes a potential trademark infringement."

Beyond the matter of patents or trademarks, the greater concern is the unknown effect on system performance and reliability when systems incorporate HFC-227ea extinguishing agent from sources other than Great Lakes or DuPont, who hold patents in this area. All of the authorized HFC-227ea suppression systems manufactured worldwide have been tested and listed or approved by an independent third party testing laboratory to ensure that each and every system is backed by sound technology, and will perform as expected in the rare event of a fire. In addition, Great Lakes maintains a separate component listing for the FM-200® extinguishing agent from Underwriters Laboratories (UL) and component approval from Factory Mutual (FM) as an independent verification of the inherent quality built into the fire extinguishing agent.

"We take our stewardship of this life- and property-saving product very seriously, " Register said. "The system and component listings and approvals by third parties are important safeguards built into the quality of these systems, and the peace of mind these safeguards offer system owners should not be compromised by utilizing extinguishing agents that do not meet these proven standards."

Register concluded that there is a need for an environmentally responsible solution for the reclamation of HFC-227ea from systems at the end of their useful service, and that Great Lakes Fire Safety will work closely with all owners of decommissioned systems to find an appropriate and environmentally responsible outlet for their HFC-227ea product.

Complying With The Law – Choices For Destruction

In addition to the limited number of approved critical applications for reuse, there are two principal halon destruction technologies available: ultra-high temperature incineration and the more state-of-the-art plasma conversion destruction technology developed by DASCEM Europe and marketed under the trademark Plascon™.

The DASCEM Plascon™ process is extremely efficient, and is capable of capturing and destroying up to 99.999% of the halon contained in a pressurized cylinder. Plascon™ is an essentially non-emissive process. Plascon™ has a proven track record in Australia, where the technology has been used to destroy more than 3,000 metric tons of halon over the past four years.

The Export Loophole

Many countries around the world continue to use halon in fire protection beyond essential use applications. Halon from decommissioned suppression systems in Europe may, therefore, be exported to these countries within the bounds of EC law and global environmental directives. However, several countries have already stopped the importation of halon and many are currently considering this action. Destroying halon removed from decommissioned systems and recycling it for approved critical uses are better, more environmentally responsible solutions.

Enforcement of the Law

The legislation passed in EC 2037/2000 is in the form of a regulation and is directly applicable to the laws of each EU member state. The failure of an owner of a halon system to comply with the mandatory system decommissioning and remediation of halon is a prosecutable offense in each country within the EU. The penalties for non-compliance with EC 2037/2000 will vary by country, but can include substantial fines, forfeiture of property, and possible imprisonment.

The Time For Action Is Now

The deadline for compliance with Regulation EC 2037/2000 is fast approaching. At this time, owners of halon systems should begin making arrangements for removal and remediation of halon and for installation of systems to provide continued protection of their critical business property and operations.

Several businesses and organizations can help halon system owners begin the transition to new fire protection systems. The Halon Users National Consortium (HUNC) offers a clearinghouse of information online at http://www.hunc.org, including updates concerning EC Regulation 2037/2000 and other guidance documents on halon phase-out and halon replacement alternatives. Additional information on ozone depletion, regulations, production phaseouts, and halon alternatives can also be found on the U.S. Environmental Protection Agency (EPA) Stratospheric Ozone Protection site at http://www.epa.gov/ozone/.

With little more than a year left before halon systems must be removed, owners of these systems should consider that the inevitable increase in demand for halon removal and replacement of fire suppression systems could leave them vulnerable in terms of both legal compliance and protection of critical assets. By addressing this situation now, halon system owners assure the availability of the options that work best for their individual applications.

Enquiries: www.rectorseal.com

Enquiries: info@cafcointl.com

Sealing Penetrations in Fire Rated Walls and Floors

Pic courtesy of Hilti Inc.

By Mike Cross, Hilti, Inc.

Sr. Fire Protection Specialist

Education Committee Chairman for International Firestop Council

Responsible for assisting customers with Firestopping applications. Offer training and technical support to the Hilti salesforce as well as conduct firestop seminars to design groups and the inspection community.

WHY IS FIRESTOP REQUIRED BY CODE?

STATISTICS PROVE that 57% of victims killed in fires every year are <u>not</u> in the room where the fire originated! Although the word "fire" tends to grab the headlines, it is the smoke and toxic fumes of a fire that quietly steals away the lives of so many people. In fact, 75% of all fire deaths are caused by smoke inhalation.

Smoke from a fire is capable of traveling at upwards of 400 feet per minute under fire conditions. Migrating smoke can rapidly infiltrate a building from floor to floor and into routes of egress making it next to impossible for victims alerted by smoke and fire alarms to escape from the building. In addition efforts to extinguish the fire by responding firefighters are often hampered by the inability to find the blaze due to dark smoke-filled hallways and stair towers.

Although it is unlikely we will ever be able to predict where a fire will start, we can limit it's ability to spread by containing it in a fire-rated envelope. Many walls and floors in buildings today are designed according to building code to carry a fire resistance rating from one to four hours. However, once a penetrating item is placed through the fire barrier, the integrity of the barrier is compromised.

Penetrating items passing through the fire barrier walls and floors of a building are manufactured from many different materials and come in a range of shapes and sizes. Building services such as piping, heating ducts, cable trays and electric busways are common penetrations found in commercial buildings.

Typically you can categorize these penetrating items as combustible or non-combustible. A non-combustible item such as a carbon steel pipe will normally survive a fire which allows for many viable solutions for restoring the original hourly rating of the fire barrier. On the other hand, a combustible item such as plastic pipe or a telephone cable bundle poses a much greater challenge.

Too often these penetrations in a fire barrier have been "sealed" using a product that is unable to stop fire and smoke from passing through. Experience and testing shows that building products such as polyurethane foam, drywall mud and non-fire rated caulks and mortars will not restore the integrity of a fire barrier due to shrinking, cracking and their inability to withstand the intense heat and pressure elements created in a fire.

HOW DO FIRESTOPPING PRODUCTS WORK?

By definition a firestop system is, a specific construction consisting of a fire-rated wall or floor assembly, a penetrating item or items passing through an opening in the assembly, and the materials designed to help prevent the spread of fire through the openings.

Firestop products are tested in accordance with ASTM E-814 ("Standard Method of Fire Tests of Through-Penetration Firestops"). It is also important to note that firestop products are tested by independent testing agencies like Underwriters Laboratories to evaluate the individual product's performance for a specific application. Most penetration systems will require firestop to be installed on both sides of a fire barrier wall, since a fire could originate on either side. Once the system passes an intense

Pic courtesy of Hilti Inc.

Pic courtesy of Hilti Inc.

furnace burn concluded by a mandatory hose-stream test, the firestop system is then designated with a specific nomenclature defining the approved application.

There are many different types of penetration firestop products on the market today. Many of these products have intumescent properties. Firestop products with this property are designed to expand under fire conditions allowing the firestop to take the place of combustible penetrating items consumed in the fire. Most intumescent products will begin to expand at approximately 250 degrees Fahrenheit and reach full expansion around 1000 degrees Fahrenheit at which point the firestop will seal off any opening left by the penetration.

PRODUCTS

Firestop penetration products come in many different forms. This product category now includes sealants, putties, wrap strips, collars, specialized foams, mortars, blocks, pillows and boards. The first step to sealing a penetration is to determine which system is designed for the specific application. Depending on the penetration, an installer will typically try to choose a product which is easily installed as well as cost effective.

Firestop sealants are installed around penetrations with a caulking gun and then tooled into place creating a tight seal to impede the passage of flame, smoke, toxic fumes and water. Putties are usually applied by hand and pressed into openings while strips are wrapped and taped around penetrating items and placed into the opening between the penetration and the rated assembly. This space is often referred to as the "annular space".

A collar device is used most often with plastic pipe applications. A collar works by intumescing and taking the place of an already deteriorating plastic pipe during fire conditions. Fire rated foams are often used to seal off difficult areas where an installer may not be able to access both sides of the fire barrier. Fire foams expand as they are installed filling voids and hollow cavities where flame and smoke tend to migrate under fire conditions. Fire blocks/pillows and boards are most often used in large openings such as cable trays, electrical busways and blank openings. Fire rated mortar can also be used as a solution for hard to fill openings.

DOCUMENTATION

The ability of a firestop product to perform properly under fire conditions depends greatly upon proper installation of the system. A firestop system directs the installer to follow specific instructions for product installation. Included with the instructions is a list of parameters with which the system must comply. If the application falls outside of the stated parameters, there is no assurance the system will perform as intended. In such an instance, an engineering judgment may be required.

Engineering judgments (EJ's) are created when tested systems do not exist for the application. An EJ is the manufacturer's opinion, based on firestopping experience, product knowledge, and related testing, of a system which would be expected to pass the stated hourly rating if it were tested. According to the International Firestop Council, EJ's must follow specific fundamental guidelines when being created. Most EJ's are created by Fire Protection Engineers by referencing existing tested systems and fire test data.

There are many variables to consider when installing firestop properly in a fire rated assembly. Size of opening, size of penetrating item, type of penetrating item, rating and construction of the fire barrier, and backing material all play a role in choosing the correct firestop system. These many variables can be confusing to an untrained installer, increasing the likelihood of a system being installed incorrectly and not performing under fire conditions. Building owners and contractors alike have recognized the potential exposure to liability associated with poor or improper firestop installation and are, as a result, turning more and more towards professional Firestop Installers.

The industry of Firestop Specialty Contractors has been growing for over a decade. In some cases building owners are turning to firestop specialty contractors to perform all firestopping during the construction phase of a building in an effort to create uniform fire barrier seals. Additionally, utilizing a firestop installation expert helps assure proper installation and peace of mind to building owners by preserving continuity within the building.

Recently, Factory Mutual has established an accreditation process for firestop installers. Traditionally, firestop manufacturers would use Factory Mutual's independent third-party testing services to obtain approval of their products. FM 4991 is the first accreditation focused on the actual firestop installer. Contractors who strive to acquire FM 4991 accreditation must designate employees who are required to pass a series of test and obtain six continuing education credits every three years. In addition to written exams, each company applying for accreditation must comply with quality control standards established by Factory Mutual.

Technology in the firestop penetration industry is changing rapidly. Most firestop manufacturers offer ongoing training to keep installers informed of new products and building code updates pertaining to firestop. A trained installer utilizing a tested system significantly reduces the possibility of improper firestop installation.

Once a firestop system has been installed, a visual inspection can be conducted to help determine the integrity of the installation. The International Firestop Council has created a pocket guide called, The "Firestop Inspection Manual". This tool takes an individual through a step by step checklist to assure proper installation of a firestop system. The guide is available through www.firestop.org or by calling, 914-332-1541.

EXTINGUISHER CLASSIFICATIONS

By PETER FREESTONE OF KIDDE FIRE PROTECTION SYSTEMS

FIRE EXTINGUISHERS IN THE UK have undergone some modest changes in recent years. The latest involves CE Marking, which has been introduced in 2002. We have seen a new fire classification, Class F for deep fat fires and let's not forget the manufacturing standards around EN3 in 1996 of which the most memorable aspect was the move from colour coding of extinguishers to all red in line with the rest of Europe. EN3 and Class F are relatively old news but before we explore CE marking its time for a recap on the different types of extinguishers and classifications.

There are basically five different types or classes of fire extinguishers, each of which extinguishes specific types of fire. Fire extinguishers manufactured for the UK since 1996 and the introduction of EN3 regulations use a picture/labelling system to designate which types of fires they are to be used on. The extinguisher body is red with some manufacturers choosing to colour code 5% of the body. Older fire extinguishers are colour coded, cream = foam, blue = powder, black = CO_2, red = water.

The different classes of equipment are as follows:

Class A type fires involves carbonaceous materials such as burning wood, paper, cloth etc.

Water extinguishers are suitable for this risk. Water extinguishes by cooling the fire, so that insufficient heat remains to sustain burning and prevents glowing embers from re-kindling. Water extinguishers usually have jet type application which produces a concentrated stream enabling the operator to fight a fire from a greater distance than spray nozzle types. As an alternative the Turbo Spray is an extinguisher with a specially formulated additive that dramatically increases water's fire fighting capability. As well as the cooling effect of water the additive provides a chemical reaction creating a rapid knockdown and also reduces the risk of re-ignition. A 3-litre Turbo Spray has a 13A fire rating, which is the same performance as an ordinary 9-litre water, so providing a 100% weight advantage. Being smaller and lighter it is easier to use when weight is an important consideration. Water is still one of the most useful and cost effective of all available fire extinguishers.

Class B type fires involves flammable liquids, such as burning petrol, oil, fats, solvents and paints.

Aqueous Film Forming Foam (AFFF) extinguishers are particularly suitable for Class B type fires, but are also the equal of water for ordinary combustibles. They usually have a spray/jet nozzle to ensure a good throw of foam which provides rapid fire knockdown and has a blanketing effect which both

smothers the flame and prevents re-ignition of flammable vapours by sealing the surface of the material.

Class C type fires involve flammable gases such as butane and propane.
Multi-purpose Dry Power extinguishers are a safe, versatile and easily used medium suited to all high risk environments or where the hazards are mixed. They are particularly suited to spillage's of flammable liquids and fires involving flammable gases such as propane and butane. They are ideal for fires in vehicles. ABC Powder is a non conductor of electricity and will provide the operator with a heat shield and extremely fast knockdown. Dry Power extinguishers are suitable for Class A, B, C, and electrical hazards.

Class D type combustion of metals, e.g. magnesium, lithium, sodium, potassium & their alloys etc.
Specialist dry powder extinguishers are available for this particular risk.

Electrical Risks.
CO_2 gas is ideal for use in modern office environments covering electronic risks such as computers, photocopiers and similar electrical equipment. CO_2 is also suitable for some Class B type fires which cover flammable materials such as solvents, oils, spirits etc. The CO_2 provides an effective performance. The gas is inert and non-damaging, showing no trace after dispersal.

Class F type fires is a recent classification established in 2000 (BS7937) involving flammable liquids specifically cooking oils and fats.
Cooking oil fires, because of their high auto-ignition temperatures are difficult to extinguish. Conventional extinguishers are not effective for cooking oil fires, as they do not cool sufficiently or may even cause flash back, possibly exposing the operator to an even greater risk. The Fryguard is a wet chemical extinguisher designed specially to tackle fires involving high temperature cooking oils and fats, which cannot be successfully, tackled using conventional extinguishants. The wet chemical is delivered as a fire spray via a long lance. On contact with the oil or fat it soponifies, causing a thick impenetrable blanket to form, rapidly extinguishing the fire.

In summary the following can be used:
Class A: Water, Water Spray, AFFF, Powder, Wet Chemical.
Class B: AFFF, Powder, CO_2.
Class C: Powder
Class D: Specialist Powder
Electrical Hazard: CO_2, Powder
Class F: Wet Chemical

CE Mark Compliance

The Pressure Equipment Directive is a European law, which applies to the safety of pressure equipment. All portable extinguishers including Co2, manufactured from May 30th 2002 will have to comply with this new directive. The Pressure Equipment Directive was originally published in 1997, being ratified by the UK parliament in 1999. It applies to all products that operate under pressure and considerable work has been needed in order to establish its precise implications for fire extinguishers. The aim of the directive is to ensure that all such products are safe in use and that manufacturing and testing procedures are the same across Europe. In order to comply with this directive, manufacturers will need to construct a technical file for each extinguisher, which demonstrates that the product's materials and construction ensure that it is safe for use in its intended function. They will also need to introduce a system to track materials and components back to the factory, so that all pressure related materials can be traced to the original source. Quality systems will need to be updated to comply. In order to gain approval manufacturers will have to enter into a contract with a notified organisation, probably BSI or LCPB. They will appraise each technical file, witness the testing of each extinguisher, check the quality system, and ensure that all materials used for the construction of each model meet the requirements of the Directive. Once assessed and approved they will be issued with an EC type or design examination certificate. The manufacturer will then be able to imprint each extinguisher with the CE mark, a symbol of compliance, and the Notified Body number and year of manufacture. One of the other requirements relating to the CE marking of extinguishers is that they are supplied with appropriate maintenance information. The maintenance recommendations within BS5306-3 are considered adequate for portable extinguishers. The new Directive does not have any affect on product that is already in service.

As these regulations only apply to new products, fire extinguishers which were originally supplied to a customer on or before May 29th 2002 and are not CE marked as compliant with the requirements of the regulations may be repaired or refurbished and returned to use after May 30th 2002. Extinguishers that are in stock and manufactured before May 29th 2002 can still be sold with no time limit. The CE is not a quality mark. It only signifies that the product meets essential safety requirements in relation to its pressurisation. The recognised quality marks including the BAFE mark, the BSI kitemark and the LPCB mark should continue to be recognised as the appropriate quality symbols.

So in conclusion, under the pressure equipment regulations, all portable fire extinguishing products manufactured after 28 May 2002 must carry a CE mark certifying their compliance with stringent safety criteria. This enables them to be purchased and used by customers with absolute confidence.

Fire doors save lives

Fire door testing. *Pic courtesy of Chiltern International Fire*

TOM GREGORY of *Chiltern International Fire* takes the view that where fire safety is an issue there is no room for error.

No one can predict how and when a fire might start. And where lives are concerned, there is no room for half measures. A door-set design with evidence for 30 minutes fire resistance, incorrectly installed, could mean the difference between fire fighters gaining access to rescue someone – or not.

Fundamental to the design of any building must be the protection of occupants from fire. Good design and careful specification will maximise the chances of detection, control fire spread and protect access routes, allowing occupants a safe means of escape and ensuring that fire brigades have access to fight the fire. There must therefore be enough exits, wide enough to do their job. By the same token, the routes to and from them must be adequately protected.

The Building Regulations, supplements and supporting legislation govern fire protection and, as a critical element of this, the provision of fire doors. In this regard, requirements are quite specific:

1. If an escape route is outside an accommodation or process area and is greater than a determined distance from a safe place then it must be 'protected', i.e. a place of relative safety, bounded by fire resisting construction (usually 30 minutes).

2. Where fire compartmentation is required to provide further safety e.g. to split up very large areas or to separate different groups of people then 60, 90 or 120 minutes fire resistance may be needed.

3. The boundaries of protected fire escape corridors and stairways must be made from fire resisting construction, of the appropriate performance. This includes fire resisting doors – bearing in mind that not all fire escape doors are necessarily fire resisting doors.

And fire door manufacturers must subject their products to stringent testing under BS 476: Part 22: 1987 (to be superseded in the near future by BS EN 1634 – 1). The fire door being tested is built into one side of the test furnace. The furnace temperature is increased at a pre-defined rate (reaching 8500°C in a 30-minute test, 9500°C for 60 minutes). Doors must prevent the passage of flames and hot gases for the relevant period in order to pass. Fire doors, without doubt, carry impressive credentials.

Fire Brigade and Building Control should be requesting certification evidence wherever possible, to minimise

...don't they?

property protection. Under the Act, the fire brigade has inspection duties and will issue a 'Fire Certificate' which defines where fire resisting walls and floors are required. The employer has a legal obligation to comply with the

time spent checking doors and to maximise assurance that a given door will resist fire for the time stated on the test evidence.

In real life, sadly, this does not happen. In time, perhaps, pressure can be brought to bear on architects to take responsibility or on developers to employ contractors who will be trained in fire safety and who will take ultimate responsibility.

This will involve a steep learning curve and will not happen overnight. As a stepping stone from the present to the ideal situation, last year Chiltern International Fire's sister company BM TRADA Certification, launched its Q-Mark Scheme for Fire Door Installers. The speed of response from the industry has been gratifying. To date 13 registered installers have joined as full members and there is a growing list of provisional members from around the UK and Ireland working towards full membership.

A key element of the scheme is training – companies will nominate one or more members of their installation team to undergo the training course and take a written exam. It is the nominated employee who will become registered under the scheme.

Fire doors are often very sophisticated products, but even the simplest can rarely tolerate error in installation, said Simon Beer, Product Certification Manager with BM TRADA. "If a window is poorly installed it will soon become obvious when the rain leaks in or the sealed unit fails. If fire doors are badly installed, one hour's fire resistance could easily be reduced to less than 10 minutes, but you probably won't know until the worst happens."

There are, of course, a wide variety of regulations and Acts that require fire resistant door-sets to be manufactured and installed. In England and Wales, Approved Document B covers fire safety in new buildings and modifications to existing buildings, in Scotland it is Technical Standard D, in Northern Ireland Technical Booklet E and in the Irish Republic Technical Guidance Document

Fire door testing. Pic courtesy of Chiltern International Fire

B. Approved Document B will soon include a 'European Supplement' (ES) to cover new European test standards, including those relating to fire doors and shutter assemblies (BS EN 1634-1).

Another important piece of legislation is the Fire Precautions Act 1971 – which relates to life safety only, not

conditions of the certificate and to notify the authority of changes to how the building is being used.

And since December 1999 most business premises have been covered by the Fire Precautions (Workplace) Regulations 1997, under which the onus falls on employers to carry out risk

Fire door testing. Pic courtesy of Chiltern International Fire

Fire door testing.

Pic courtesy of Chiltern International Fire

assessment. Adequate specification and maintenance of fire doors is a key part of this requirement.

But nowhere is fire door installation rigorously inspected at any stage. Added to this, most major projects involve several different partners, none of whom is directly responsible for checking fire door installation – and it is all too easy to assume that checking has been done by someone else.

Ironically, while Part B of the Building Regulations does not stipulate third party certification, it strongly recommends it, stating: "Since the performance of a system, product component or structure dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and registration of installers and maintenance firms of such will provide confidence in the appropriate standard of workmanship being provided....Third party accreditation and registration of installers of systems, materials, products or structures provide a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby increasing the reliability of the anticipated performance in fire."

BM TRADA firmly believes that its Q-Mark scheme does exactly that. The scheme gives independent, third-party certification that its members are doing their job correctly – and the peace of mind that goes with it. Small details matter. If intumescent specification is wrong, or glazing beads badly installed, this can be easily missed by the untrained eye. Yet this could mean a door only resisting fire for 15 instead of 60 minutes and jeopardising the lives of a ward of bed-ridden patients.

Under the Q-Mark scheme, the registered installer's work will be audited on site twice a year. This means that BM TRADA will inspect installations at members' customers' premises, a fact which has been well received by those customers. "Far from considering it an imposition, customers see it as a big advantage of the Q-Mark scheme," said Mr Beer. "Some have been so impressed by the stringency of the audit, they have gone on to specify Q-Mark for all future projects."

This is certainly true of one of Swift Southern's major customers, a full member of the scheme. Their registered installer Chris Moore said his company had joined the scheme "to prove our competence as installers to our clients". He also appreciates the fact that BM TRADA will keep him up to date on best practice in fire technology and help interpret new regulations and standards. And he particularly welcomes the forward-looking nature of the scheme. "When we finish an installation we provide a manual for the client detailing precisely how the fire doors should be maintained, how they may or not be adapted and by whom."

After installation, fire doors may be moved if a building is partitioned, perhaps, or its function changes. Clients might decide to install a vision panel or make other modifications. It is essential that any changes do not compromise

Fire door testing.
Pic courtesy of Chiltern International Fire

performance. The manual supplied by Swift Southern will enable them to go straight back to the installer or even the manufacturer for adaptations, to ensure that performance is not impaired.

As with all its Q-Mark schemes, BM TRADA targets a level of performance which goes beyond the market average. Simon Beer said: "To create confidence, we believe the requirements of the scheme should be set to provide enhanced performance of the product. Legislative requirements must be met, but durability and standards of workmanship should go beyond the norm."

In this way, he added, products in the scheme can be differentiated from rivals as better products. "Scheme membership must be based solely on meeting technical requirements. It is vital that the certification body is not tempted to lower its requirements to draw in more customers. This can only devalue the scheme and, in the long term, destroy its credibility."

Across the Q-Mark fire door manufacturer and installer scheme there are four categories of membership, although members may fulfil the criteria for more than one category:

- door blank supplier
- door/set manufacturer
- fabricator (must use Q-Mark approved door blanks)
- installer.

A series of colour-coded plugs denotes the status of the fire doors and a unique identification number pinpoints the manufacturer or installer. Top of the range are the silver and gold-centred plugs – silver for full factory hung door-sets and gold for door-sets which have been fully manufactured under the scheme and installed by a registered installer.

Members appreciate the quality of the plugs, which are "a more secure way of marking the products than the labels employed by other manufacturer schemes. Because the plugs are discreet and of very high quality, they don't detract from the finished product. They are deliberately located at eye level on the door/frame edge where they are easy to see, without the need for any special measures or devices."

To find out more about the Q-Mark scheme contact Simon Beer on 01494 569821 or E-mail sbeer@bmtrada.com.

- Timber Fire Doors Explained – Chiltern International Fire/BM TRADA run regular one-day seminars at High Wycombe. Contact Tom Gregory for full details on 01494 569812 or email tgregory@chilternfire.co.uk.
- Chiltern International Fire will also provide a free video explaining the process of fire resistance testing – contact Tom Gregory (see above) to obtain a copy.

No going back

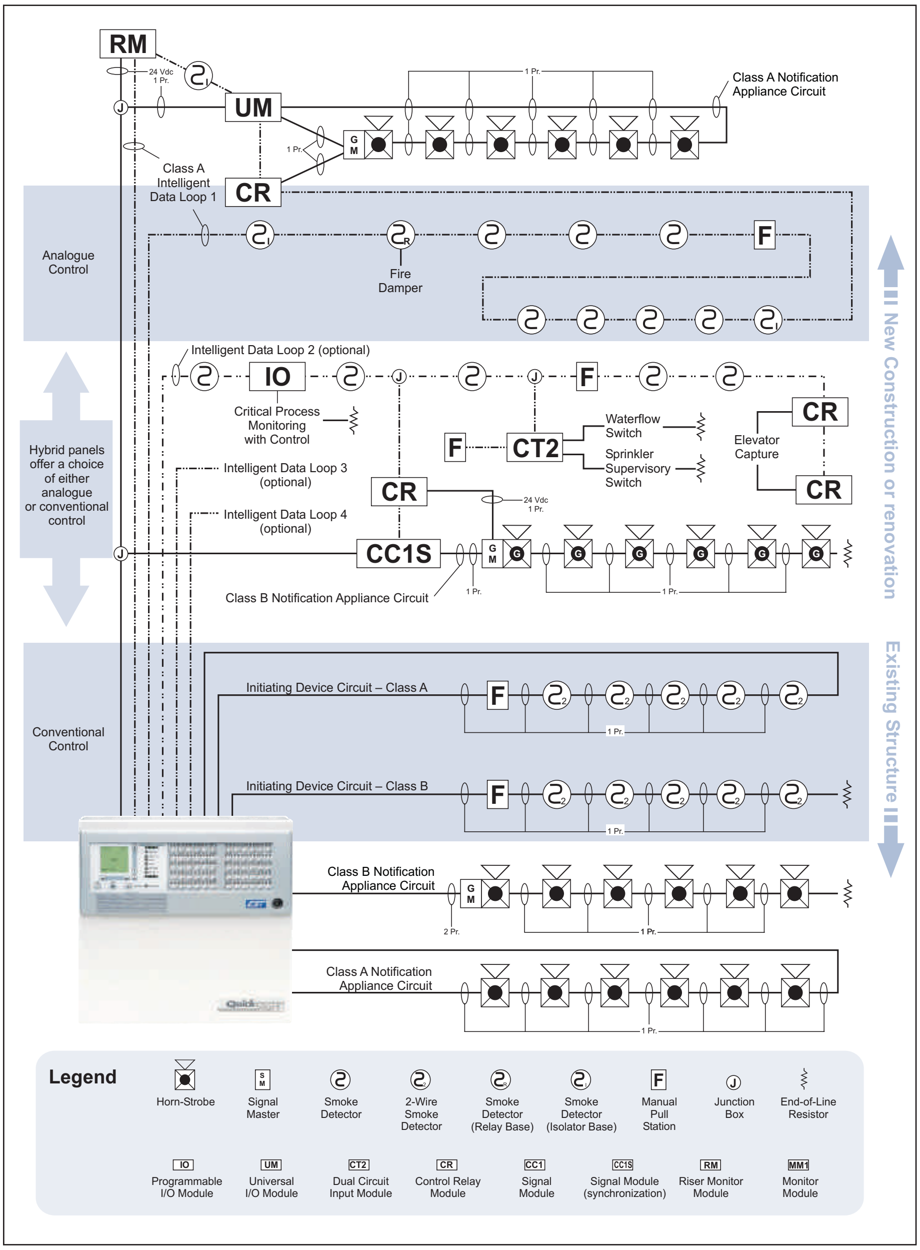
ANALOGUE-ADDRESSABLE fire alarm control has hit its stride among large and mid-sized applications. The question now is can the cost and configuration barriers be lowered enough to bring it to maturity among small building applications as well?

By Okay Barutcu

Only a short while ago, it seems, analogue-addressable fire alarm control panels were found only in highrise buildings, large campus-style installations, and commercial/industrial complexes. The truth was, microprocessor-based intelligence was simply too expensive for small building applications. The sophisticated technology didn't justify the expense in small buildings. But things have changed, especially during the past year or two, and the future of fire protection – for buildings of all sizes – is now inexorably tied to analogue-addressable control.

While some manufacturers have developed conventional products that support analogue-like features, true analogue-addressable fire alarm systems represent a significant improvement over conventional systems on the market today. First, with support for intelligent addressable devices, the state and condition of any device can be pinpointed and checked from the front panel. Conventional systems, on the other hand, are typically based on zoned control, which provides information only about the group of devices on a single wiring loop. If one detector is dirty or causing a trouble condition, all the devices on that loop need to be checked in the field, one at a time.

Analogue-addressable control also increases system reliability and reduces the chance of nuisance alarms. Unlike



Conventional/Analogue-addressable Hybrid sample layout.

conventional systems, which only recognize when a device changes the state of a zone (i.e.: from normal to alarm), intelligent devices process information on a continuous basis. This means, for example, the device can track and compensate for the effects of the gradual accumulation of dirt, and will signal the control panel if it is in need of service long before it becomes ineffective or issues a false alarm.

This kind of self-diagnostics is particularly important when it comes to meeting the testing requirements of local fire codes. In fact, more and more panel-generated diagnostic reports are accepted in lieu of manual testing of each device. And that can save a lot of time, trouble, and expense on a regular basis.

ANALOGUE-ADDRESSABLE SYSTEMS GAINING MARKET SHARE

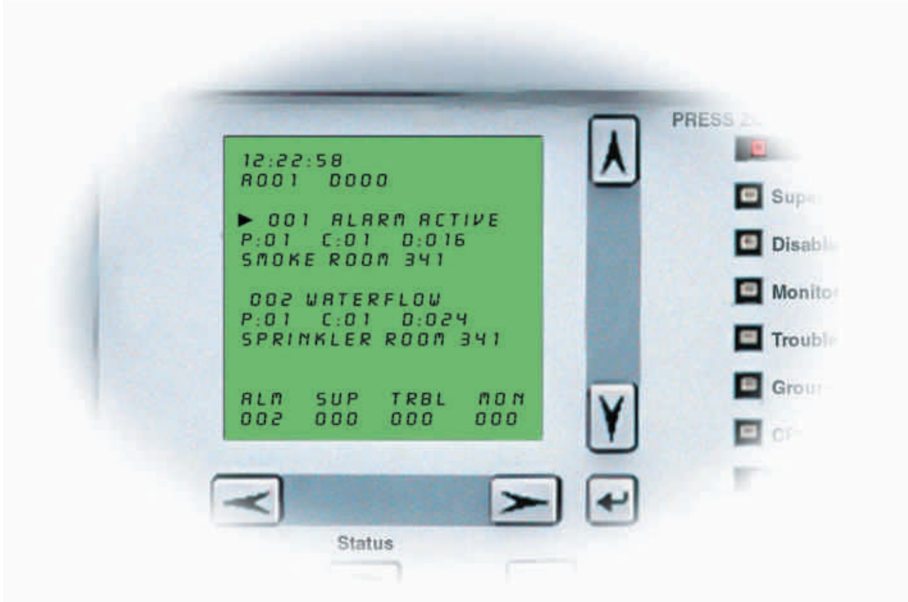
While analogue-addressable control has offered many distinct advantages over conventional fire alarm systems for

No going back

quite some time, the trade-off in terms of expense and relatively complicated installation has kept it largely in the domain of large installations. Among larger systems an economy of scale has made the choice of an analogue-addressable system one that reaps significant benefits to both the contractor and the building owner. Until recently smaller installations could not justify that leap.

Lately, however, the cost of analogue-addressable control has come down significantly. The price of microprocessors is low; on-board memory is relatively cheap; and manufacturers have recouped the high cost of development to the point where they can now offer the technology at less of a premium than before.

Not long ago contractors were reluctant to install such systems in buildings that required fewer than 1,000 detectors.



Analogue-addressable control supports the front panel display of details including the device type and location.

Today industry insiders agree that this threshold has dropped to between 50 and 80 detectors. Small office buildings and lowrise residential complexes now make likely candidates for analogue-addressable control.

The most significant factor in the spread of analogue-addressable control to small building applications has been cost, but technology has played an important part as well. Sophisticated features at the high end of the scale have led to crossover products at the low end. Today manufacturers are able to offer scaled-back versions of technology originally developed for large applications. This technology is ideally suited to smaller applications because it's simpler to implement, easier to install, and economical.

HYBRID SYSTEMS MAKE TRANSITION TO ANALOGUE-ADDRESSABLE EASIER AND LESS COSTLY

Once complicated to program and configure, analogue-addressable systems are now loaded with features that streamline installation. Those very features are making them attractive for small building applications.

The most notable panels geared expressly for small buildings are the new generation of hybrid analogue/conventional systems. These offer low-cost conventional control, or cost-effective analogue-addressable control, or a flexible combination of the two.

Let's say you have a small building: new construction; twenty detectors – too small to justify an analogue-addressable system. But you know that the planned phase two of construction will quadruple its floorspace. A hybrid system is ideal for such an installation because it can start out as a conventional panel serving the first phase of construction for as long as necessary. For phase two of construction, the addition of a loop controller at the control panel will give it analogue-addressable capability to serve intelligent devices installed with the new construction. Meanwhile, existing conventional devices can be replaced with new intelligent devices and brought on-line at any time after the control panel has the added analogue-addressable capability. Existing field wiring can be reused, and the panel doesn't even need to be replaced. The cost of the job meets the needs of the application without committing to analogue control before its cost is justified. The end result is an analogue system for the entire building at a fraction of the cost of replacing an outdated control panel and all its connected devices.

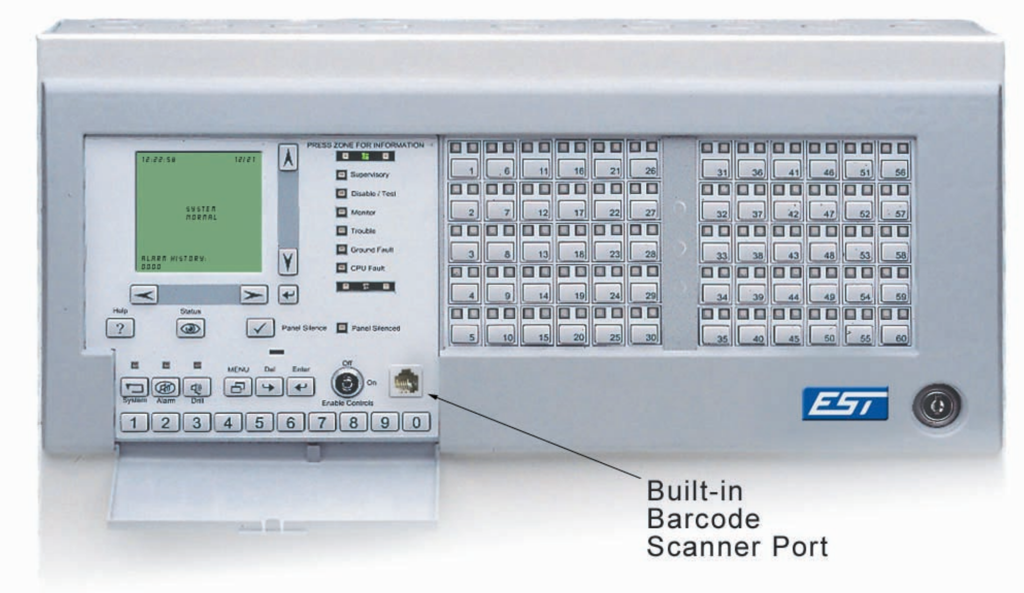
The phased-in approach for new construction does away with the all-or-nothing limits of traditional analogue-addressable control. In retrofit situations the cost and performance benefits are even more significant because hybrid control panels offer a convenient and cost-effective migration path to analogue-addressable control.

This allows aging conventional systems to be replaced in stages. As areas of a building are renovated, conventional detectors can be replaced with intelligent devices according to a timetable that suits the owner's budget and renovation schedule. The change-over can occur so that it has the least impact on building occupants, for example, when a tenant's lease expires. Because there is no need to retrofit an entire fire alarm system at once, work can even be scheduled over a number of weekends – without any lapse in fire protection between visits by installers.

INNOVATIONS MAKE ANALOGUE-ADDRESSABLE MORE ATTRACTIVE TO INSTALLERS

While the convenience of hybrid control panels have gained them significant headway in the market, systems geared for small buildings are now loaded with features that make them easier to install and service as well. Programming and configuration improvements streamline the process for installers so that they spend as little time on-site as possible.

One of the greatest advantages of analogue-addressable control over conventional systems is the support for addressable devices. With this support, an analogue-addressable panel can display details about the location and condition of any intelligent device on



Innovative control panels today support barcode scanning by means of an integrated scanner port.

the system. The tricky part is registering the location and type of device with the system so that it can display these details when required. When the amount of time an installer spends setting up a system determines whether or not analogue-addressable control is a cost-effective solution, this factor takes on a great deal of importance.

Recognizing this, manufacturers have come up with several innovative shortcuts that speed setup and installation for analogue-addressable systems. Because every installation presents different challenges, look for a control panel that supports a range of programming methods, including laptop programming, barcode scanning, autolearning, and front panel configuration:

- **Autolearning** is a routine invoked by the installer after the field devices are connected. Much like the search for new hardware sequence found on today's plug-and-play PCs, the Autolearn routine looks for connected devices and registers their device addresses with the control panel. Autolearn also determines whether any hardware options are installed with the control panel and makes sure they are working correctly. Autolearn is vital to any small building analogue control panel because it provides a base upon which device-level details can be built. While it identifies which devices are connected, it remains the installer's next task to associate the device addresses with meaningful location information such as "CAFETERIA", "3RD FLOOR WEST", "UTILITY ROOM", etc. This information is displayed by the control panel when required.
- **Laptop programming** is a method that was inherited from big analogue-addressable systems. It involves downloading data from the system, modifying it with a proprietary Windows® based software package, and then uploading the new data to the control panel. This method is useful for larger systems and where relatively complicated setup or extensive text inputting is required. It is also useful for associating text details with devices following the Autolearn routine. Panels that support laptop programming come with a port to which a laptop serial cable may be connected.
- **Barcode scanning** is an innovative alternative to laptop programming for associating text with device addresses. Here's how it works: each detector includes a unique address represented by a barcode that appears on the device itself and on the end-flap of the box it came in. As each device is installed, the installer simply writes its location on the box next to the bar code and tears off the flap. Back at the control panel the autolearn sequence is run. Then the installer scans the bar code from the box flap and inputs the location information written next to it for reference. The control panel automatically associates the device address with the text information that follows. This text information may also be scanned into the system by means of a series of sheets carried by the programmer that has bar codes accompanied with plain language translations for text, digits, and frequently-used words such as "EAST", "WEST", "BASEMENT", "ROOM", etc. Control panels that support barcode scanning have built-in scanner ports that accept a connection for compact pencil-style barcode scanners. For routine programming and setup, this option provides the most convenient method of text and numerical input.
- **Front panel programming** is a viable option for initial system setup and for making minor changes to text and numerical data. Text input for more than a handful of devices, however, can quickly become tedious and time-consuming, even among control panels that have dedicated buttons for each letter in the alphabet. Unlike barcode scanning, there are few shortcuts for repetitive text, and unlike laptop programming, there is no familiar QWERTY-style keyboard to speed text input.

INNOVATIONS DRIVE THE FUTURE

Analogue-addressable control panels offer the versatility and reliability of intelligent fire alarm systems, making built space safer to occupy than ever before. They are far better at what they do than conventional systems with zoned control. While barriers to the universal acceptance and application of analogue-addressable systems remain, these barriers are rapidly coming down. Lower overall cost, the convenience of hybrid systems, and innovations such as autolearning and barcode scanning are all working in favour of analogue-addressable control panels as they edge out traditional conventional control in the world markets today.

The future of small building fire alarm control will undoubtedly reflect innovations and developments among analogue control addressable panels. As we continue to lower the feasibility threshold for analogue-addressable systems and extend their reach into ever-smaller applications, conventional systems will diminish in importance. Whether analogue-addressable systems will eclipse conventional control altogether remains to be seen. But one thing can be said for sure: once analogue-addressable takes hold, there is no going back.

Okay Barutcu is Regional Director, Europe and South Africa, for EST International. He is based in Arundel, UK.

HI-FOG®
water mist fire protection

Tested.
in over 5000 full-scale fire tests

Approved.
by Classification and Approval societies worldwide

Proven.
in real fires on land and at sea


hotels & offices


computer rooms & telecom facilities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HI-FOG features

- superior fire suppression performance
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- reduced water consumption due to small droplet size
- special systems for smoke scrubbing
- high-quality materials

HI-FOG benefits

- minimal fire, water and smoke damage
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- improved safety for people, property and the environment

MARIOFF

***Marioff Corporation Oy**, Finland*
Phone +358 (0)9 870 851, fax +358 (0)9 8708 5399, e-mail: info@marioff.fi
www.hi-fog.com

Canada • Denmark • France • Germany • Italy • Norway
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WATER MIST ROUND-UP

CHEMETRON WATER MIST SYSTEMS

Chemetron Water Mist Systems provide safe fire protection for occupied spaces and critical assets. Our Water Mist fire protection systems utilize a very fine water spray and are designed to extinguish fire using a limited quantity of water as compared to standard sprinkler systems.

Water is an outstanding physically acting agent as a result of its exceptionally high heat absorbing capacity and latent heat of vaporization. It is a clean agent suitable for a range of sensitive applications and where people are involved. The Chemetron Water Mist system functions as a stand alone modular extinguishing package with: water tank, nitrogen cylinders, valves, gauges and control panel.

For more information please contact:
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Fax : +1 708 748 2852
www.chemetron.com

FIKE FIRE SUPPRESSION

A water mist system is defined by NFPA 750 as a system that produces a "water spray" with 99% of the water droplets discharged having a diameter less than 1.0mm. Water mist systems vary drastically from sprinkler systems in both operation and the amounts of water required to extinguish a fire.

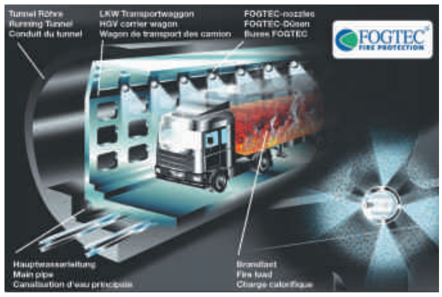
The increased interest and industry acceptance has also led to the development of **Fike Corporation**'s "Micromist" water mist suppression system. The Micromist system is a self contained, single fluid, pre-engineered water mist fire suppression system for total compartment protection of machinery spaces and compartmentalized gas turbine generators. The Micromist system employs a brass nozzle which has demonstrated excellent performance extinguishing flammable liquid (Class B) fire scenarios.

The Micromist system uses several primary methods to extinguish fires including cooling, oxygen displacement and blocking the spread of radiant heat to nearby fuel sources (wetting).

The Factory Mutual approved Micromist system provides cost effective fire protection which is people safe and environmentally friendly. In the event of a fire, the Micromist system will ensure rapid extinguishment, easy cleanup and rapid restoration to normal operations.

For more information please contact:
Fike Corporation
Tel : +1 816 229-3405
Fax : +1 816 229 4615
www.fike.com

FOGTEC FIRE PROTECTION



FOGTEC Fire Protection is the leading supplier of water mist systems for land based applications based on several decades experience in water mist. A wide range of products is offered for applications such as production facilities, food processing, generators, turbines, hotels, offices, IT and telecom rooms, museums, tunnels, off shore and marine risks and many others. FOGTEC's own offices in Europe, Asia and North America give first class support to clients. The largest global network of fully trained system partners within the water mist industry guarantee international users the best possible maintenance and service.

FOGTEC runs its own fire, nozzle and hydraulic test facilities for continuous research work and customer driven project research. A unique team of graduated engineers covering the topics Chemistry, Mechanics, Hydraulics and Fire Science is the basis for FOGTEC's engineering support and consultancy work for its clients.

WATER MIST ROUND-UP

Only high pressure systems and water mist of Class 1 (NFPA 750) are used for highest efficiency. FOGTEC products are approved by international authorities for land and marine applications. All products are manufactured in compliance with ISO 9001-2000.

For more information please contact:
FOGTEC Fire Protection
Tel: +49-(0)-221-96 22 30
Fax: +49-(0)-221-96 22 330
www.fogtec.com

LPG AQUAFOG

Combinations of basic sets of cylinders form the **LPG AQUAFOG** fire suppression system. A basic set comprises 50 lt. cylinders with discharge valve containing water at atmospheric pressure, nitrogen cylinder/s pressurised at 200 bar with opening valve and release system. The set is completed with pressure switch, pressure gauge, manifold, discharge hoses, non-return valves, strainer and bracket.

Systems are designed to be actuated through manual/electric release or manual/pneumatic release. The system ensures that once one of the nitrogen cylinders is actuated the remaining nitrogen cylinders in the system will actuate automatically pressurising the water cylinders.

AQUAFOG operates at working pressures from 200 to 50 bar producing very tiny droplets. Nozzle heads are designed to discharge water as a fine mist (SMDª50 microns). AQUAFOG systems are designed according to NFPA 750 Standard.

LPG has developed specific applications for AQUAFOG water mist system

such as protection of mechanical escalators. This application is focused to protect running tracks, base of tunnel area and machinery areas giving an excellent fire extinction performance and providing safe conditions for evacuation (limits temperature, limits smoke level and doesn't reduces oxygen level). Water mist design overcomes volume integrity problem that is usually a

problem for gaseous agents. This application has been successfully tested under VdS.

As water mist systems provide a quick and efficient extinguishments for flammable liquid fires, LPG has also developed a system for protection of kitchen hoods. Protection includes the deep fat fryers, hoods and ducts. This system provides fast extinguishing of flames and cooling of hot oils to avoid re-ignition in order to guarantee protection.

For more information please contact:
LPG Técnicas en Extinción de Incendios, S.A.
Tel : +34 93 480 2933
Fax : +34 93 473 7492
www.lpg.es

HI-FOG WATER MIST FIRE PROTECTION

Marioff is the leading supplier and developer of water mist fire protection systems. Marioff's HI-FOG high-pressure water mist technology is based on rigorous full-scale fire testing, and has hundreds of patents and approvals by various authorities. It features fast suppression or extinguishment of the fire, radiant heat blocking to prevent fire spreading, minimised water damage to buildings and equipment, and safety for people and the environment. The mist is delivered at high velocity, achieved with pressures up to 140 bar, using small-bore piping and high-pressure pumps or charged nitrogen cylinders. Application specific HI-FOG systems are currently available for computer and telecom rooms, hotels and offices, museums and heritage buildings, machinery spaces and turbine enclosures, metros and tunnels, industrial wet benches, offshore applications, passenger ships and cargo vessels.

Latest applications include a concept for aircraft hangar fire protection. Marioff's HI-FOG system for aircraft hangars uses a minimal amount of plain water without any additives.

Therefore, corrosion risk is not greater than what arises from plain water exposure. The system has been proven in full-scale fire tests to be ideal for extinguishing jet fuel fires. Water mist has a superior cooling effect and superior radiant heat blockage capabilities, reducing temperatures around and under the aircraft instantly after the system has been discharged. Fire damage has been shown to be restricted to that of the time of detection. A fire test summary, including a test series with a F-16 aircraft mock-up, and a confirming test with a real F-104 aircraft, is available upon request. Marioff has already delivered two projects to Norwegian Air Force to protect their F-16 aircraft.

Marioff has entered tunnel fire protection sector by delivering a tailored solution to protect a car-parking tunnel in Italy. Marioff's tunnel concept consists of HI-FOG sprinklers together with water mist curtains. Thanks to the thermal management capabilities of water mist, no detection equipment is necessary. A HI-FOG system with open spray heads can be combined with a detection system.

For more information please contact:
Marioff Corporation Oy
Tel : +358 987 0851
Fax : +358 987 085399
www.hi-fog.com

SEMCO MARITIME

Water mist for offices and public areas:

There are several reasons for choosing water mist in offices, hotels and other public spaces. First of all, the high pressure water mist creates one of the best fire fighting methods by attacking the fire both by cooling the temperature and by oxygen suppression.

Further, water mist systems use a very small amount of water, which reduces the water damage dramatically, and insurance companies in some cases are willing to compensate the end users of the water mist installation, with lower insurance premiums. So the installation can be a good investment in more than one way.

The installation of the water mist system creates a lot of advantages, for instance less space is needed for installation than say a gas suppression system, this means that double ceilings and enclosures for piping can be avoided. At **SEMCO MARITIME** we also produce a system for installation directly into concrete ceilings.

The fine water mist also catches sparks and smoke particles and washes it out of the air avoiding damage to equipment and the interior of the building.

How water mist functions:

Water mist is water which is pressurised at 100 bar, to create a fine mist or fog on activation. The fine water mist evaporates very quickly and becomes steam. The steam removes oxygen, thus smothering the fire. At the same time the evaporation of water creates the most efficient cooling. In this way the fire is extinguished both by oxygen suppression and cooling, and thus has the advantages of both water – and gas-based fire suppression systems. High-pressure systems only create high pressure during extinguishing; the stand-by pressure is much lower. High-pressure systems will cool the areas around hot metal surfaces and will evaporate before it reaches the hot metal. Thus shock cooling and changes in metal structures can be avoided. Low-pressure water mist is also available from Semco, but does not present any technical advantage for this application.

Semco have been working with high-pressure water mist right from the start, and this new – revolutionary system – finds its way to more and more areas, offering the clients an efficient system, which is both environmentally friendly as well as harmless to the users.

For more information please contact:
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Tel : +45 65683800
Fax : + 45 65683830
www.maritime.semco.dk

ULTRA FOG AB, SWEDEN

Ultra Fog was one of the first companies in the world to be involved in introducing high pressure based water fog. It was one of the pioneers.

The foundation for the strong driving force behind Ultra Fog was, and still is, to build systems, in the first place to save human life, and secondly to save property.

Ultra Fog is the only company that has its own technique to create the fog through high pressure. This technique is patented throughout the whole world.

Development and construction are and have always been the most important building stones in the company since it opened for business in 1991.

Today Ultra Fog has 40% of its business on the landside and 60% by the marine side. Ultra Fog systems cover most of the application spaces, machinery spaces, different kind of technical spaces. The systems can either be as a total fixed system or as a local protection system.

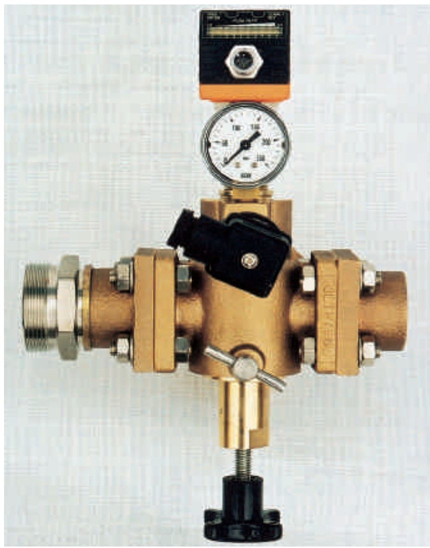
Our special designed nozzles (patented) can be placed to a height up

to 12 mtrs. (Illustration of nozzle please study photo. Is available also as open type nozzle)

Ultra Fog´s patented nozzles are the key to achieving maximum water delivery at the optimal droplet size. These nozzles have been developed over the past 10 years to achieve a balance between:

- Water mass delivered.
- Number of droplets produced.
- Size of droplets produced.
- Speed of droplet delivery.

We have also developed our own section valves, for a safe reliable function. The section valve can either be hydraulic, mechanically operated or solenoid operated.



Systems can be delivered either as a pump station solution or a pressurised bottle system.

The main reason that the high pressure waterfog system is an outstanding extinguishing product, is that the system fights all the parameters of the famous fire triangle. (Material, Oxygen and Heat)

The system is also an environmentally friendly extinguishing system, which also is harmless for the human breathing.

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Sound Advice

Bob Choppen, Product Manager with fire protection equipment manufacturer Fulleon, examines some of the problems facing system designers regarding the use of sounders and highlights the areas which need to be considered to ensure effective performance.

SOUNDERS ARE AN INTEGRAL PART of most fire detection systems yet they are often the component that is least understood when it comes to system design. A degree of ambiguity can certainly be attributed to the standards, both British and European, which are deliberately flexible in their allowing system designers to find their own methods of achieving the target sound levels. Lack of quality information regarding sounder layout also contributes to the problem which is further exacerbated by the lack of uniformity in the sounders available. All of these factors ensure that a system designer needs to be well aware of the various issues which affect a sounder's performance if potentially costly mistakes are not to be made.

Recognising that the standards do not offer the depth of guidance for sounders that they do say for detectors, does not in any way suggest they are less important. Designing any part of a fire detection and alarm system is not to be undertaken lightly or without training and an understanding of the relevant standards. The location of each detector, manual call point and sounder has to be engineered to ensure that it suits the purpose of the system and the risks that may be encountered in each area.

There is however a fundamental difference when it comes to the layout of detectors and manual call points when compared to alarm devices. BS 5839 Part 1: Code of Practice for system design installation and servicing, devotes considerably more space to ensuring the correct layout for detection devices than it does to guidance on alarm sounders. Using the information therein the system designer can practically work out his detection package with the aid of drawings and a scale rule. For sounders all that is provided is a target sound level, leaving the problem of achievement up to the designer.

This difference is understandable; performance of installed sounders is relatively easy to measure using a hand held instrument. To be too prescriptive with installation information could be counterproductive to achieving the performance required. Detection systems are difficult to assess when installed and therefore safeguards are required to ensure consistent performance.

For similar reasons the EN54 series of European standards follow different philosophies for detection and alarm devices. Detectors have to meet set sensitivity levels, while alarm sounders merely have to provide an output between 65dB(A) and 120dB(A).

This provides great flexibility for alarm sounder manufacturers, but conversely makes the task of the systems designer much more difficult to execute without any uniformity between products.

IS THIS A PROBLEM?

While most system designers will happily quote precisely how many detectors of each type are required for a project, the number of sounders will usually carry a caveat that sounder quantities are subject to final measurements on site.

As stated earlier, designing a sounder layout requires a range of information that is not always readily or accurately available, nor is there such a thing as a standard alarm sounder. The result is that the sounder layout and predicted performance is something of a lottery. Systems tend to be under-designed resulting in extra costs to make up the short fall at the end of the project. In some instances the effects can be far reaching – if the systems circuit loadings

Sound Advice

and power supply ratings are exceeded, or extra installation work is required in an almost finished building.

THE ISSUES

How Loud?

- The first piece of information required for the design process is the ambient noise level expected to be present when the building is complete and operational. This is difficult to ascertain with any accuracy and may have to be predicted by comparison with similar existing buildings. (BS 5839 Pt1 2002[1] will include typical sound levels for various types of location, but tolerances are wide). The level will vary considerably from one part of the building to another, from canteen to warehouse to office area. The designer must also take into account any processes or activities that could produce increased noise for a period likely to exceed 30 seconds, again something that will not be obvious from drawings.

  Often forgotten is that there may be extra noise resulting from the emergency itself – smoke control fans, shutters etc all contribute to an increased level of noise which can drown the output from sounders in some areas.

  The requirement in the UK, recommended by BS5839 Part 1, is 65dB(A), or 5dB(A) above any background noise likely to persist for longer than 30 seconds and 75dB(A) at the bed head of a sleeping person.
- Where background levels over 85dB(A) are encountered, consideration has to be given to the augmentation of audible alarms with visual signals. This also applies if people are likely to have any form of hearing impairment, (Disabilities Discrimination Act) or may routinely use ear defenders.

Which sounder?

This may sound a trivial decision, but as mentioned earlier there is no standard sounder, they all perform differently. In some cases the choice is predetermined by company manufacturing and purchasing policies.

- The choice for fire systems lies between electronic sounders in various formats and bells. Older types of sounder such as motor driven sirens and hooters generally take too much current to be compatible with modern systems.
- Most electronic sounders have a wide range of alarm tones from which to choose, but not all are suitable for fire alarm use. Countries such as the Netherlands, Germany and France have standardised alarm tones, but not the same tone, nevertheless a standardised signal is recommended nationally. The UK has no such standardisation; only a recommendation that the frequencies produced by the sounder should lie in the range 500Hz to 1000Hz. The tone must be continuous for an evacuation signal, but this still allows the use of many different temporal patterns, such a steady single tone, a two-tone (warble), a sweep (whoop) or buzz.

  The tone used should, of course, not be confused with any other alarms used around the building. This can prove difficult in process industries where similar sounders may also be used as machine alarms.

  Voice sounders, which produce a speech message in addition to an alarm tone, are a further consideration and may be of particular benefit where specific information has to be communicated or where the general public are expected to be present. Research has proven them to elicit a more positive response from the public than tone only sounders.
- Frequently ignored is the fact that sounders do not radiate sound equally in all directions, and that this directionality will vary from type to type. Figure 1 shows the pattern for two different sounders each with an on-axis output of 100dB(A) at 1m and set to the same tone. The contours trace the location where the sound

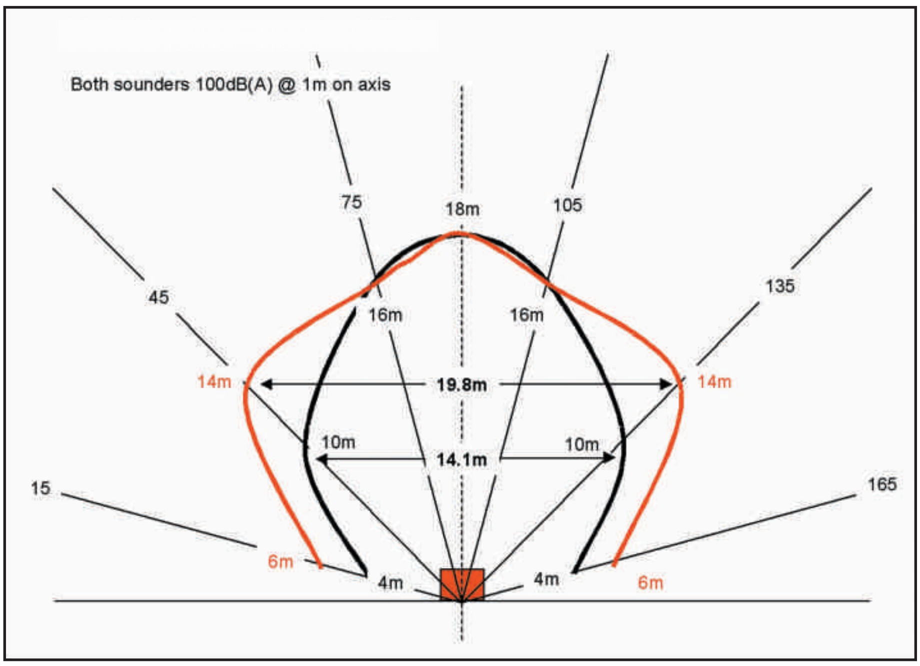
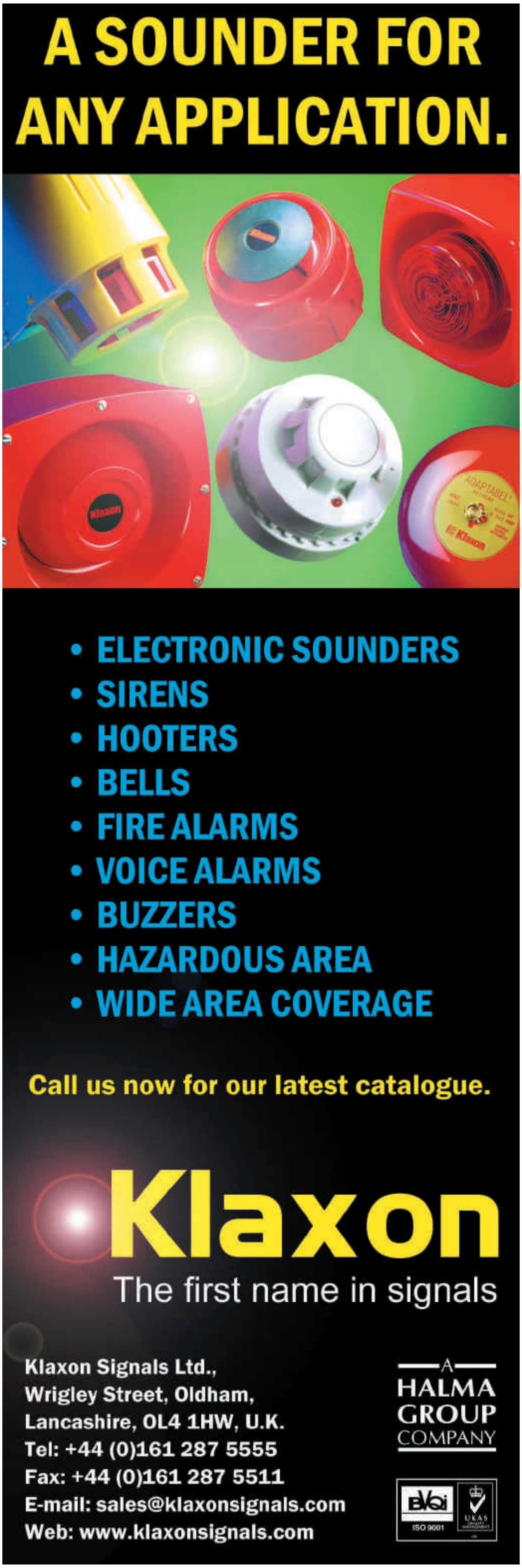


Figure 1. Sounder coverage for 75dB(A)



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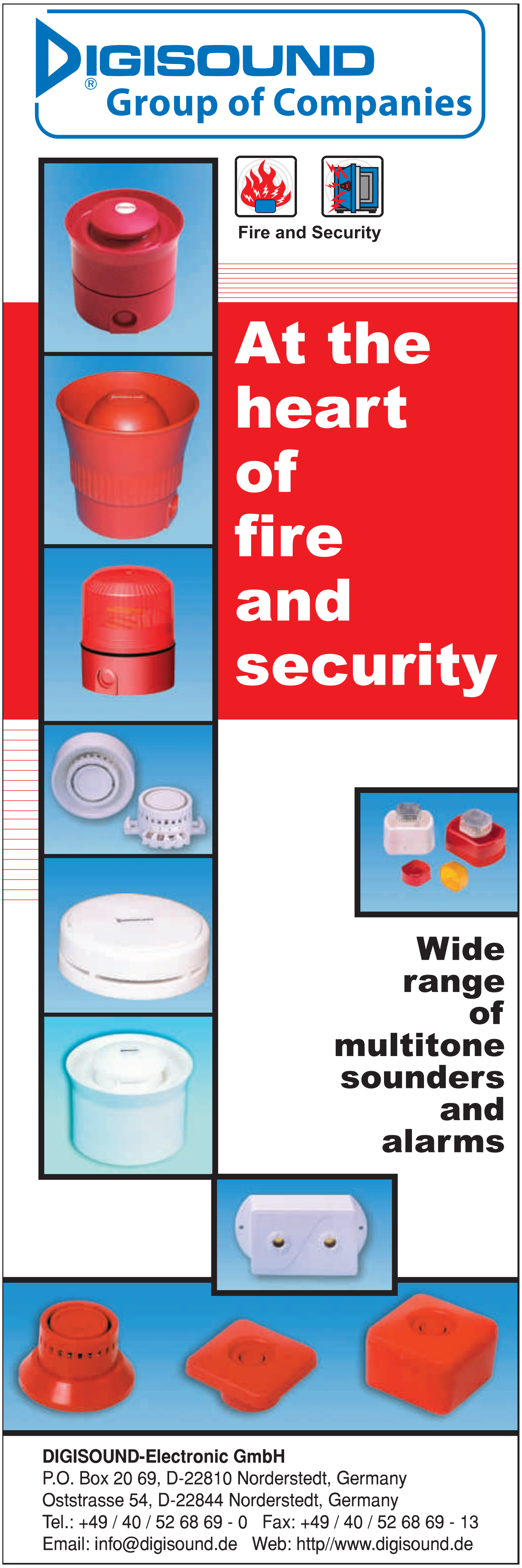


Enquiries: www.digisound.de

Pic courtesy of Fulleon Ltd

level has dropped to 75dB(A). The sounder with the red trace has much better lateral coverage at 19.8m, than the black trace at 14.1m, so in situations where multiple sounders are required, fewer would be needed using the fist unit.

Sounders also perform differently according to which tone is used – this will affect, their output level and current consumption. This is perhaps a minor consideration with small systems, but on larger sites both the number of sounders and the power supply requirements can be affected.

- It is inevitable that larger installations will require a number of different types of sounder to provide adequate coverage. BS 5839 Pt1 recommends that sounders should sound "similar". This is often a point of contention where some authorities read "similar" to mean "identical". What is important is to ensure that the signal is readily

identifiable by building occupants. People can identify sound patterns relatively easily, but are much less capable of determining the pitch of the signal. It is therefore necessary to ensure the temporal patterns of the sounders are alike, but the absolute frequencies are much less important.

To ensure the temporal pattern is clearly distinguishable the sounders within hearing range must operate in phase, otherwise confusion will arise as the signals overlap and interfere.

- Because it does not respond in a linear fashion, the human ear contributes to the difficulties of measuring sound pressure and hence the need to use a logarithmic measure for sound i.e. decibels. Note that sounder figures are rated in dB(A), the "A" referring to a weighting used on measuring instruments that corresponds to the frequency characteristics of the human ear.

If any of the information used in designing a sounder layout is inaccurate the consequences can be major. An increase in overall sound level of 3dB, probably the smallest change that most people can readily detect, requires a doubling of the power, equivalent to doubling the number of sounders. For the sounders to appear twice as loud a change of 10dB would be needed or an increase in power of 10 times. Adding extra sounders and power supply upgrades is never cheap. This highlights the need for accurate information in the early stages of a design if the solution is going to be anywhere near correct.

CONCERNS

The points outlined above cover only the basic acoustic performance aspects, as they are the primary features that contribute to the effectiveness of the sounders in buildings, yet are probably the least well understood part of fire system design. The concern is that there seems to be relatively little published information to help the system designer with his task, either in terms of calculation techniques or the data on which to base those calculations.

Obviously sounder manufacturers can shoulder some of the blame for limited information, but at the same time there seems to be little demand or interest to drive the need for anything better.

As mentioned earlier, voice is a powerful tool in the management of emergencies and its use is growing steadily, but this brings another level of detail to the design process. Whether using voice sounders or a public address based voice alarm system, additional skills are required of the designer. Alarm sounders require only audibility to be effective; if people can hear them and know how to react then the goal has been achieved. Voice messages have to be both heard and understood, so in addition to audibility there is the additional requirement to achieve intelligibility too.

> Accepting the situation is as it is, with sounders largely free of performance constraints, yet installed systems assessed on performance, perhaps the industry should move toward a standardised presentation of information and better documentation of the techniques used to predict performance.

[1] The figures used are largely taken from BS5839 Part 1:1988, at the time of writing BS5839 Part 1: 2002 is in final draft. This revised document will provide some opportunity variations to the figures suggested above.

The Process Plant Loss Control System

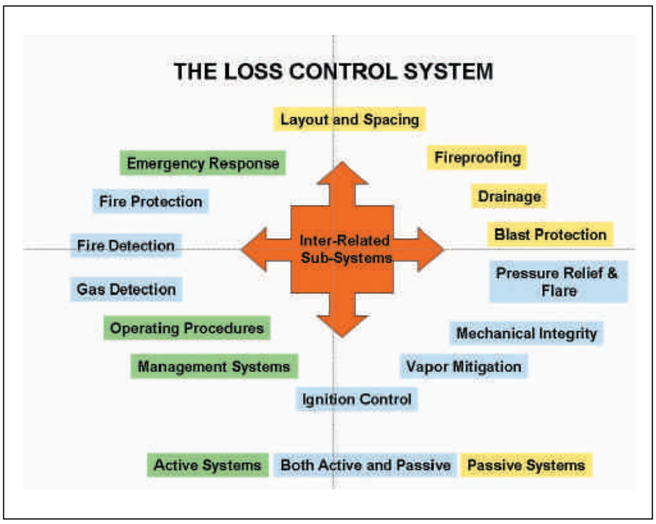
By William S. Fink

HISTORICALLY, TOO MUCH EMPHASIS has been placed on the role of "active" fire protection equipment and systems as primary loss control measures within a process plant. Many times, engineers and insurers have reviewed plant drawings or toured process areas and made recommendations for extensive fire protection systems, fire detection, and fire equipment, with little regard for the "passive" loss control provisions. Also, many designers do not fully understand the inter-relationship of the various sub-systems as they relate to loss control.

The objective of this article is to provide a better understanding of the overall loss control system in a process plant, from the design phase through the plant or unit's operational lifespan. It should be first understood that there is always a need for fire detection systems, fire protection equipment, and systems, but the provision of these systems should be balanced against other loss control measures that may have a greater impact on maintaining a safe process and preventing a release of material, fire, or explosion.

Process plant loss control is not just the provision of fire protection equipment and fire protection systems; it is a "system" in itself. This system begins very early in the design stage of a process plant and lives throughout the life of the process plant. It includes a variety of inter-related sub-systems that work together cohesively at the time of an incident to protect personnel, the public, adjacent assets, and limit any loss. These sub-systems can be categorized as "passive" and "active" based upon how they act or react during an incident.

For the purpose of this article, an "active" system is one that requires human intervention at the time of an incident to set some actions in motion. A "passive" system includes those design items or systems that require no human interaction and/or are designed to automatically take action under certain conditions. The figure below lists a number of the typical passive and active subsystems that may be employed in the loss control system. In some instances, the sub-systems, such as fire protection systems, may be passive if they are automatically activated, or active, if personnel must activate the system by opening a valve or pushing a button. A number of these subsystems will be discussed to provide a better understanding of this inter-relationship.



DECISION TIME

Early in the budgeting stage for a revamp, modernization, de-bottlenecking, or grassroots project decisions, should be made on the conceptual loss control measures that will be employed in both the design and operating phase of the plant. All too often these decisions are made without regard to the operating life of the plant.

For example, with the advent of improved process control and advanced control systems, many duties that were once performed by plant operating personnel are now performed by the control systems. As such, the manpower that was available to respond to a plant emergency has been reduced considerably. To compensate for these changes, the use of "passive" sub-systems should be increased.

Likewise, adjustments to the "active" sub-systems may be equally appropriate. In other words, as the manpower is reduced, additional design features should be

The Process Plant Loss Control System

considered to provide an equivalent level of protection. Traditionally, the operating staff that was needed in the process area to operate the process also played a key role in release or fire reporting. There may now be a need for automatic fire detection by systems such as combination infrared/ultraviolet fire detection equipment. The use of remotely operated closed circuit video cameras has also increased where the control room operator needs to see high-fire potential areas, such as pump rows or large compressors. There may be a need for remote isolation of high fire potential equipment such as pumps or compressors to rapidly isolate the source of the release and limit the loss.

LAYOUT AND SPACING

One of the best passive techniques in limiting a loss is through proper layout and spacing of equipment, both inter plant and intra plant. In the days of pneumatic controls, increasing separation distances between process plants and between individual equipment items was not feasible or cost effective due to the high cost of instrumentation and piping. This produced tight equipment arrays and minimized separation distances between process plants. Equipment such as heat exchangers, drums, separators, fin-fan coolers have been commonly stacked on top of each other within structures to minimize costs and to fit a process in the given space available. Tight equipment arrays impact the degree of confinement when a vapor release occurs and may produce higher blast overpressures.

Technology has now advanced to the extent that we can assess the impact of equipment spacing on potential loss scenarios and make informed decisions on the amount of risk that a company can accept. Electronic distributed controls have largely replaced pneumatic control systems. As a result, the cost and operational impact of increasing spacing to provide better personnel access, egress, and reduce losses is not as severe.

With the current hard insurance market and high insurance premiums, the cost of risk should be carefully factored into plant design. For example, maximum loss calculations that largely determine the insurance premium to be paid should be given critical consideration when making decisions on the spacing and layout of a plant. In addition, the proximity of the public to the process plant should also play an important part in deciding how much "buffer" land is needed around the process area. Typically, lower risk facilities such as storage tanks, utilities, or green belts are placed between the process areas and the property lines. To reduce the maximum loss calculations, high value high fire potential processes can be separated by lower value, lower risk processes.

The costs of utilizing noncombustible fill in cooling towers as opposed to the traditional wood filled cooling towers has also decreased and can be offset by lower long-term maintenance costs. Limiting the amount of flammable liquid or gas in a given process vessel also has a significant impact of the loss control measures in a process. Operations personnel have traditionally wanted large liquid volumes to permit more time for operators to respond to a given situation. With the process control provided today, these inventories can in many instances be reduced since the process computer reacts more quickly and efficiently to an off-norm situation.

FIREPROOFING

Fireproofing should be provided for the protection of structural support and for the protection of critical instrumentation and/or power cables. Fireproofing is typically measured via laboratory testing that indicates the exposure time for a specific item, such as a structural steel member, to fail under fire conditions. In evaluating fireproofing ratings and test results, one must pay particular attention to the fire tests used in these ratings. In 1918, the standard time-temperature curve (ASTM E 119) was adopted for testing structural components and simulates interior structural building fires. This test method does not correlate well to hydrocarbon and other pool type fires.

In 1984, Underwriters Laboratories (UL) adopted the first high-rise time-temperature curve in conjunction with the oil industry (UL-1709). The high-rise time-temperature curve reaches a temperature of 2000°F (1093°C) in 5 minutes and is representative of a typical hydrocarbon pool fire. As such, fireproofing used in facilities that process hydrocarbon type fuels should provide fireproofing based upon the UL 1709 or equivalent testing techniques. The attached figure compares the standard time-temperature curve, and the high-rise time temperature curve.

American Petroleum Institute (API) Publication 2218, Fireproofing Practices in Petroleum and Petrochemical Processing Plants is an excellent reference document. It outlines a systematic methodology for assessing a potential hazard within a plant, developing appropriate fire scenarios, defining the fire-scenario envelope, conducting a needs analysis, selecting appropriate fireproofing systems, and installing the system according to specifications.

The amount of fireproofing that is provided should be balanced against the fire potential, the layout and spacing of buildings, equipment and vessels, and operating considerations. For example, where there is a need for operational control of valves during an incident, there may be a need to provide fireproofing of these systems or in the area adjacent to the valves for an extended period of time.

DRAINAGE

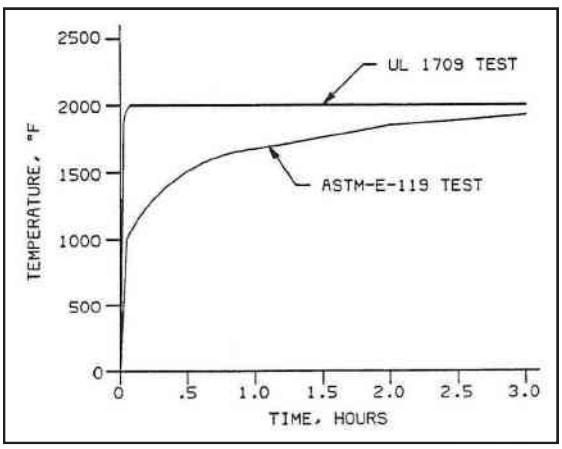
Proper drainage must be provided in the process areas to drain both rainwater run off and spilled process liquids from the area. When establishing the drainage patterns in a process area, the drainage patterns should be away from equipment to more open areas and out from under pipe racks and cable trays. As such, the high point of paving should be directly under the main pipe rack, which typically acts as the dividing line of drainage run off for the process area. Catch basins for the run off should not be located under equipment or pipe racks. For the protection of personnel, they should also not be located in areas where operating personnel may need access during an incident.

The goal is to provide enough slope away from the equipment to enable spilled liquids to drain rapidly into catch basins and not permit the build-up of large liquid pool fires under or adjacent to critical equipment arrays. The drainage should be properly sized to dispose of a realistic "worst-case" rainfall rate (e.g. – 2 inches in an hour), plus spilled process materials at an agreed upon rate, and firewater runoff.

Provisions to contain and dispose of contaminated fire water run off must also be adequate for the duration of an incident to prevent the drainage system from backing up into the process area.

BLAST PROTECTION

Buildings, which house personnel and are normally occupied, such as centralised control rooms, should preferably be located out of the estimated blast zones. These blast zones can be calculated based upon scenarios specific to the process and related



Time temperature curve. *Courtesy of RJA*

materials and should be developed with input from design and operating personnel. Where buildings will be normally occupied and located in the blast zones, structures should be provided with blast resistant construction equal to the calculated blast overpressure for that area of the plant.

In some cases, protective films can be used over windows to limit flying glass that may result from the blast wave, when the building itself can withstand the blast overpressure generated. In more severe instances, windows may need to be deleted from the side of a building that faces the process area. In extreme cases, such as explosives plants, the control rooms may need to be constructed as a blast bunker with sloped walls so that the blast wave rides up and over the building. Where critical equipment such as deluge system valves are located or remote isolation valve controls, blast walls may be need to protect this equipment from the blast overpressure of an incident.

PRESSURE RELIEF & FLARES

In today's process plants, the pressure relief valves for flammable liquids and gases are more often than not routed to a closed system that provides for recovery of the material or proper disposal in a plant flare. The flare system includes piping that routes materials from the pressure relief valves, into a main header, through knock out drums where liquids are retained, and the remaining gas is burned in a flare. In many cases, there are vapor recovery systems that recover as much of this waste gas as is economically feasible.

The flare should be located at a safe distance from process areas, storage tanks, buildings, and other structures based upon radiant heat studies. These studies should include a detailed analysis of the time required for a pressure relief valve to relieve materials into the flare system, the anticipated temperature, quantity, pressure, and composition of materials in order to determine the maximum flare system loads. These maximum loads are used to design the hydraulics of the system and also to calculate the radiant heat from the flare.

The radiant heat calculations should result in a protected buffer zone around the flare to ensure that the radiant heat from the flare does not ignite combustible materials. These buffer zones should also include some consideration for the release of burning scale from the flare that may build up over long periods of use. There have been a number of fires where storage tank pressure/vacuum vents or seals just outside the radiant heat buffer zone have been ignited by burning scale carried down wind of the flare. Where this potential exists, additional protective measures may be required.

In some cases, the flare system may also include manually operated rapid depressuring valves that will quickly release pressure from a process vessel into the flare system. These rapid depressuring systems are typically used where there is a need to relieve pressure from a process vessel in a short duration to protect the process or the equipment. Where these systems are used, they should be considered "critical" systems and should be protected from fire exposure for a specified period of time (usually 15-20 minutes) to ensure that the system will properly function in the initial stages of a process unit emergency.

MECHANICAL INTEGRITY

The mechanical integrity aspects of the loss control system in a process plant are far-reaching and very complicated. The mechanical integrity program at a plant begins early in the design stage and remains active during the life of the plant. Some of the loss control contributions of the mechanical integrity program include the design specification for piping, process vessel, and storage tanks, pump and compressor seals, flange ratings, nondestructive inspection requirements, and many other items too numerous to describe here.

The potential for a release of material in any given process plant is influenced greatly by the decisions made early in the design stage. For example, on piping systems designed to handle corrosive flammable liquids, piping wall thickness specifications should include consideration of corrosion rates. The selection of piping materials is also determined by an assessment of the temperature, pressure, and composition of the materials being handled.

In some cases, the probability of a release from piping systems can be reduced greatly by using piping with a greater wall thickness. Another example would be the use of high integrity pump seal materials and/or double seals with monitoring of the space between the seals for leakage past the primary seal to prevent a release to the atmosphere.

The mechanical integrity program after the plant is operating also has a significant loss control contribution. The monitoring of vibration on pumps and other large rotating equipment provides data that can be used to predict a potential failure before it occurs. Firewater pumps should be included in the rotating equipment monitoring program since they are expected to function in a reliable fashion.

The ongoing periodic inspection of plant piping systems, pressure vessels, heaters, and boilers provides necessary data that can also predict a failure before it occurs. Pressure relief valves should be tested periodically to ensure that they are operable within acceptable limits and that process materials are not building up at the inlet to the pressure relief valve, reducing its capacity or ability to open fully when required. Failure of a relief valve can rapidly escalate into a major loss.

Fire protection equipment and systems must be included in the mechanical integrity program. Firewater spray and sprinkler systems require periodic maintenance and must be tested to verify that they remain operational. Foam systems on storage tanks also require testing. While it is understood that it is difficult to test these systems, some provisions can usually be made to test the equipment while it is in service. As a minimum, these systems should be tested when the plant is down for periodic maintenance. National Fire Protection Association, NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems should be consulted for more information.

FIRE PROTECTION SYSTEMS

Fire protection systems include fire detection and alarm systems, fire suppression systems, foam systems, and the provision of manual fire fighting equipment. These provisions are dictated in many instances by the local authorities and by national codes, such as the National Fire Protection Association codes. However, these provisions should also be balanced against the other loss control measures provided at the facility.

For example, if it is known that the drainage in an existing process area is inadequate and it may take several years to obtain capital funds to improve the drainage system, foam systems and equipment should be provided to suppress the vapors from spilled liquids or to control a pool fire in the area. If isolation of pumps or other equipment can only be accomplished at the equipment itself, then water spray or foam system protection should be provided in that area for personnel protection. Proper personal protective equipment should be provided in this example.

Likewise, if high fire potential equipment, such as hot oil pumps, are provided with high integrity seals, periodic rotating equipment vibration monitoring is conducted, the equipment is not located under a pipe rack or other equipment, and is provided with remotely activated shut down and isolation valves that are fireproofed, then the need for fire water sprays over the pumps may be questionable. In this case, the pump can be isolated during an emergency and shut off remotely with limited personnel exposure and with minimal damage to adjacent and overhead equipment. Active protection may not be a critical requirement in this scenario.

SUMMARY

The intent of this article is to identify some of the loss control contributions of various plant sub-systems to the overall loss control system. Some of the items included in the loss control system chart have not been discussed, but may be equally if not more important. As indicated, it is very difficult to totally isolate or separate the interaction of these sub-systems, but they should be considered on a "systems" basis. If they are not, improper protection may be provided, or not provided at all. Interrelationships between protective elements may be violated, and the loss control system may not be as effective as is should be. Finally, capital funds may be wasted on protection that is not required.

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AUTRONICA FIRE AND SECURITY

Fire Protection in Communications Centres

Dr Dave Smith
Business Development Manager
Kidde Products

Communication centre. Pic courtesy of Kidde Products

Communications Centres

Until quite recently, the term 'communications centre' might have applied to land-line telephone exchanges and relatively little else. Today, with telecommunications and the internet having experienced massive growth over recent years, it describes a vast and widespread infrastructure on which we depend daily in our work and personal lives. Included are facilities large and small owned by communications service providers as well as those forming part of many commercial business premises.

The facilities themselves house costly high technology equipment but it's not enough simply to reduce hardware loss. Lost revenue due to downtime is a key concern and many businesses now aim for 99.9999% uptime. Fire has the potential to disrupt service at the very least and, in extreme cases, can deal a financial blow from which many businesses cannot recover.

Communications facilities typically contain rows of rack-mounted equipment. While the available hardware is becoming smaller, there remains pressure to use space effectively. In fact, miniaturisation of equipment, increasing energy densities and growing heat output means that the risk of fire is growing rather than diminishing as a result of hardware compaction. We face, therefore, a challenging set of circumstances involving a high concentration of fire risk.

Delivering a fire protection solution for these locations is essential. A risk assessment identifies the hazards, their probability of occurring and the potential consequences and this is then reviewed relative to the level of protection sought. In communications centres, an electrical fire hazard dominates although this could occur within the racks or in cabling, much of which may run in ceiling or underfloor voids. Other factors include high air flow maintained to cool the equipment which can affect especially the fire detection methodology. Fire growth is usually quite slow and the aim is usually to detect any fire at an incipient stage, often electrical device overheat, and to curtail this event before any notable combustion causes damage due to heat, smoke and other corrosive fire gases. In doing so, we achieve the goals of preserving life

Fire Protection in Communications Centres

safety, minimising loss or damage to equipment and ensuring service continuity. The latter guarantees on-going revenue, preserves customer confidence and guards against possibly widespread knock-on effects of communications failure. The solution is to design an integrated systems package which comprises suitable detection, alarm, control and active suppression components.

> *The solution is to design an integrated systems package which comprises suitable detection, alarm, control and active suppression components.*

Fire Detection Options

Detectors fall primarily into three categories depending on whether they respond to smoke, heat or flame. The first type is commonly used in communication centres, computer rooms and EDP facilities and itself falls into two sub-sets, those of point detectors and high sensitivity aspirating systems.

Optical and ionisation point detectors may be located in the protected area and are allied with a suitable alarm and agent release protocol. When detection occurs in one zone, an initial pre-alarm signal is raised which allows the condition to be investigated and interventive action taken. In these 'double knock' systems, a signal from a second independent detector is needed to initiate agent release from an automatic system.

Point detectors can detect smoke at 3-5% obscuration per metre so whether they can identify fire at a sufficiently early stage can depend on their positioning relative to the overheat and the dynamics of the induced air flow in the enclosure. High sensitivity aspirating detection offers improved performance in mission critical facilities where down

time must be minimised and where air flow presents special difficulties.

Aspirating systems are inherently more sensitive to smoke than conventional point detectors, recognising as low as 0.005% obscuration per metre. Air is continuously drawn to the detection unit [usually one per area] from pre-determined sampling locations within a pipe network. The HART XL is

These devices are, therefore, very sensitive to smoke concentration and may be used without compromising the sensitivity of the detector.

Aspirating smoke detection system. *Pic courtesy of Kidde Products*

one such system which offers exceptional performance owing to its special particle counting technique. As smoke passes into the sampling chamber, a sensor electrically counts the particles and discriminates between smoke and other matter by individual setting of the upper and lower particle size detection thresholds. These devices are, therefore, very sensitive to smoke concentration and may be used without compromising the sensitivity of the detector. In a similar fashion to the double knock protocol, multiple alarm levels are set to give pre-alarm warning before any automatic suppression may be activated.

In some cases where the location is always manned by suitably trained

Fire Protection in Communications Centres

personnel, automatic fire suppression may not be selected. A thorough risk analysis must confirm this approach, however, and very careful consideration given to whether this option is appropriate.

Fixed Gaseous Fire Protection Systems

There are two types of 'new generation' agent employed: liquefiable chemical gases and non-liquefiable inert gases. These have arisen as a result of the ban on Halon production from 1994 and are in ever-sharper focus owing to the recent European regulation EC 2037/2000 which requires all non-essential Halon systems to be removed from service by the end of 2003. All viable agents must be environmentally-acceptable, clean gases at ambient temperatures and offer effective 'total flooding' performance below defined human toxicity levels. Also, they must be recognised in current standards [e.g. BS ISO 14520] and be offered in third party-approved systems.

Suppression cylinders.
Pic courtesy of Kidde Products

Chemical Gas Systems

HFC227ea is the most prevalent chemical gas and is commonly available under the trade name FM-200. Acting primarily by heat absorption, it is deployed at a design concentration typically of 7.5%, poses no asphyxiation threat and is non-toxic with reference to its No Observable Adverse Effect Level [NOAEL] of 9.0% and Lowest Observable Adverse Effect Level [LOAEL] of 10.5%. It may be used up to the NOAEL without mandated egress times and up to the LOAEL provided that personnel are exposed for no greater than five minutes.

FM-200 is non-corrosive and electrically non-conductive and lends itself ideally to communications facility protection.

The systems themselves comprise one or more cylinder/valve assemblies, each of typically 5-250 L capacity, containing liquid agent under 25 bar nitrogen pressure. The minimal storage requirement of less than twice that of Halon 1301 compares favourably with all other viable systems.

All gas discharges result in some pressure excursions in the protected area. Since FM-200 concentrations are relatively low, there is commonly no requirement to provide over-pressure venting.

A further advantage arises from the requirement in the standards to discharge within ten seconds, thus ensuring rapid fire extinguishment. This can be especially important where rapid fire growth is possible or where secondary heat and smoke damage to sensitive equipment must be minimised.

Inert Gas Systems

These agents are also non-corrosive and non-conducting but differ from chemical agents in a number of respects. They are stored at high pressures of 150-300 bar and, while physically-acting, they rely on reducing the oxygen concentration to around 14% at which combustion is prevented.

There are several gases available featuring argon and nitrogen, singly or in combination, while one variant also contains some carbon dioxide.

Design concentrations are rather higher than for FM-200 at around 40%. They remain safe for human exposure, however, with a NOAEL and LOAEL of 43% and 52% respectively.

Owing to the greater quantity of gas to be released, discharge times are usually one minute. The need to avoid significant pressure build-up in the protected area and allow displacement of air means that dedicated venting is needed which is calculated at the design stage.

Although the number of agent cylinders is higher relative to FM-200, inert gases flow very readily through the discharge manifold which enables the systems to be housed perhaps hundreds of metres from the risk zone. This ease of flow also allows the engineering of complex agent distribution paths for more challenging applications and, for independent multiple zone protection, central storage systems protecting more than one area via distribution valves.

The Fire Protection System Selection Process

Which system package is most appropriate is derived through a case-by-case analysis. The fire professional will work closely with the customer and other relevant authorities such as the insurer

There are several gases available featuring argon and nitrogen, singly or in combination, while one variant also contains some carbon dioxide.

Pic courtesy of Kidde Products

and contracted facilities managers and consultants as appropriate. Many recognise the benefits of high sensitivity smoke detection in particular for swift warning of a potential fire event. Of the fixed automatic total flooding systems, both chemical and inert gas systems are capable of offering the effective fire extinguishing performance sought for communications centres. Where floor space is strictly limited, for example, FM-200 would prevail. Where the system must be placed some distance from the protected area, an inert option only would be practicable. In all cases, ventilation in the protected area must be shut down and dampers closed prior to discharge to enable the agent concentration to be retained for at least ten minutes.

Closing Comments

With the modern global communications infrastructure, no man or woman need be an island. Similarly, fire protection systems do not comprise individual parts but form integrated detection, alarm, control and suppression systems working together, this then becoming part of an overall strategy which includes good housekeeping, safe use and maintenance of equipment (including that of the fire protection systems) and staff awareness.

An holistic approach is important in protecting communications facilities from loss and business disruption by fire. As part of this philosophy, fire protection systems will continue to play a pivotal role in detecting and acting against the potentially devastating effect of fire in these environments.

Video-based fire detection

Fire detection provides an essential component in many fire protection system designs. Fire alarms systems initiate public egress, start smoke control systems, and actuate fire suppression systems. The majority of fire alarm systems used today consist of various smoke detection technologies. These technologies include spot-type ionization and photoelectric detectors, air sampling smoke detectors, and linear projected beam-type smoke detectors. Fire alarm system designers also use optical fire detectors for rapid flame detection in applications ranging from off-shore oil drilling platforms to aircraft hangars. All of these fire alarm technologies continue to improve. One goal of improvement is to provide faster responses to real fire sources while eliminating nuisance alarms. In addition, improvements include features that reduce maintenance, testing and installation costs.

By Daniel T. Gottuk, Ph.D., P.E.

An alternative detection technology that provides unique advantages compared to the typical fire alarm systems has now become available. Computer processing and image analysis technologies have improved significantly over the course of the past decade. This improved technology has allowed the recent development of effective video-based fire detection systems. Fire protection system designers initially employed these for use in large facilities, outdoor locations and tunnels. However, video-based detection is being investigated and used for a broadening range of applications. For example, these systems are currently installed for use or evaluation in electrical power plants, paper mills, document storage facilities, historic municipal buildings, nuclear research facilities and automotive plants. U.S. Navy personnel have begun evaluating the use of video-based fire detection systems for operation onboard Navy ships.

For facilities – whether a ship or a building – that already have a video security system, installers can easily add a video-based detection (VD) system without the installation of additional wiring or devices throughout the facility. The image analysis and alarm algorithm software forms the heart of a VD system. This software can run on a standard PC. Or, installers can use an industrial computer, a PC designed with specific video application hardware and features, such as automatic system restart upon loss of power.

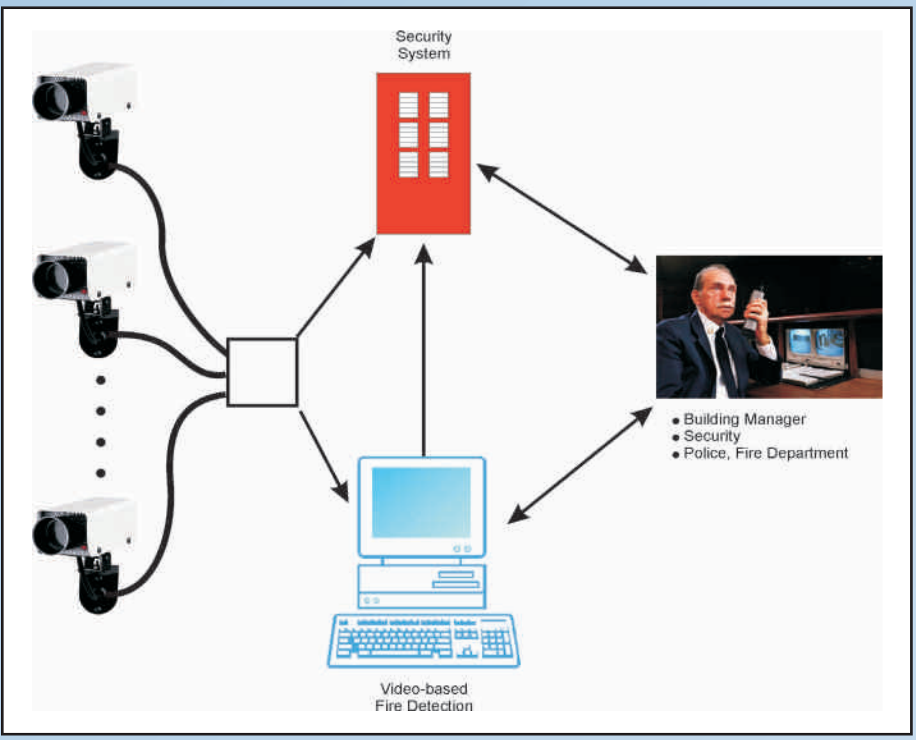

Figure 1. Integration of a video-based fire detection system.

Figure 1 shows a general configuration of a video-based fire alarm system. The images of surveillance cameras can serve as inputs to both a security system and a VD system. The fire alarm system then processes the video to identify smoke or flame within the image. The VD software evaluates multiple parameters, such as contrast, brightness, size, speed of development and dynamic behavior of the image, before initiating an alarm. When the system verifies an alarm condition, it displays the alarm on a graphical user interface (see Fig. 2). The system can also output the alarm signal to other monitoring and control systems, such as existing fire alarm/security panels.

Over the past five years, video-based fire detection companies have primarily focused on the use of smoke detector algorithms for fire detection. Though these systems can detect very low levels

of smoke, some very-low-smoke flaming fires can challenge the detection sensitivity of the VD systems. However, these fire types, such as certain gaseous fires or alcohol fuel fires, do not represent a large fraction of fire scenarios in most applications. To provide a more robust video-based detection system, manufacturers have been developing and optimizing flame detection algorithms for the identification of flaming fires. The integration of both smoke and flame detection algorithms should provide the systems with greater sensitivity to a broader range of fire sources.

The ability to use the basic hardware of the VD system (i.e., the cameras and wiring) for multiple purposes is clearly one of the primary advantages of this technology. Integrating video-based fire detection with a video surveillance inherently minimizes certain installation, maintenance and service costs and can increase system reliability. For example, compared to an inoperable smoke detector, that may not be identified until service personnel perform an annual test, a video image used for multiple purposes will be checked more frequently. Other than the main computer that operates the video-based detection system, the use of this system does not add additional costs for the testing or maintenance of hardware than would already exist for the video surveillance system.

Routine testing of the VD system can prove relatively simple. A single person can perform this testing at the main computer console. Similar to addressable smoke detection systems, the VD system will self-monitor for abnormal conditions, such as low or exceedingly high light levels, video loss, significant image changes, or obscured camera images. If this self-monitoring detects an abnormal condition, the system will generate a trouble signal.

Video-based fire detection systems provide simulation modes. These modes can generate digital alarms to verify correct functioning of the system displays and outputs. However, the simulation mode does not test the alarm algorithms. A service technician can perform a full functional test by either conducting a live fire/smoke test, or by simply inputting a pre-recorded video of a fire/smoke source, such as one obtained during the commissioning of the system.

Because of the recent introduction of the VD technology, currently no organisation (e.g., ISO or NFPA), or the industry itself, has established test protocols for approving or conducting functional tests of video-based detection systems. Therefore, these systems are generally designed, installed and commissioned using a performance-based engineering approach, rather than using prescriptive requirements.

Video-based fire detection systems provide unique advantages in a wide

Figure 2. Example of an active monitoring display of a VD system graphical user interface. *(Pic courtesy of Fastcom Technology)*

Figure 3. Video-based fire detection in a power station. *(Pic courtesy of Fire Sentry Corp.)*

> *The use of this system does not add additional costs for the testing or maintenance of hardware than would already exist for the video surveillance system.*

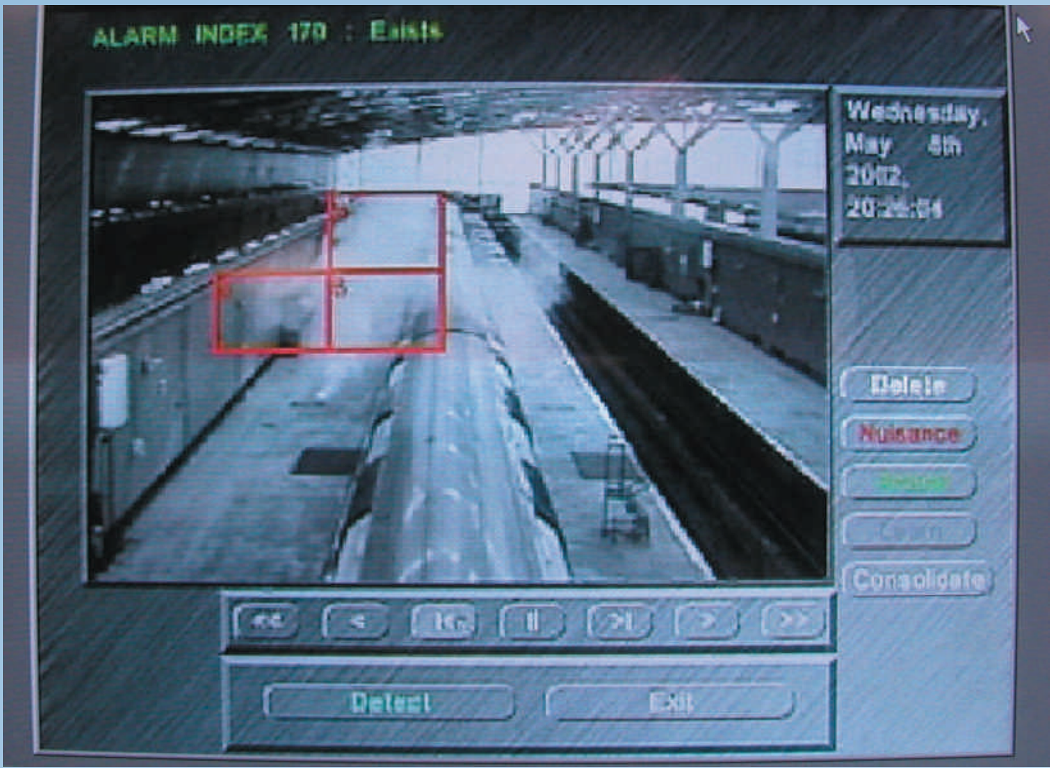

Figure 4. Video-based fire detection in a train station. *(Pic courtesy of Fire Sentry Corp.)*

range of applications. One advantage these systems offer is the ability to protect a larger area, while still achieving fast detection. In many large facilities with excessive ceiling heights, designers find it impractical to use conventional smoke detection devices. These applications can result in smoke from a fire becoming diluted before it reaches spot-type or linear projected beam-type smoke detectors. In some cases, due to ventilation and thermal gradients, smoke may stratify as a suspended layer below the ceiling or be restricted from reaching the specific area of detection coverage. In all of these cases, the variables presented by the excessive ceiling heights can significantly impede fire detection. This will lead to larger fires and greater property damage.

Video-based fire detection systems can cover a large area and do not require the smoke to reach any specific point location. As long as the smoke appears within the field of view of the camera, the system can detect it. Consequently, the VD system can detect smoke closer to the source. This leads to faster response times. Figure 3 shows an example of a large facility application.

Further work is needed to determine whether or not the VD systems have an advantage in coverage and speed of response over air sampling smoke detection and spot-type detectors in smaller, congested spaces, such as electronics or storage spaces. The U.S. Navy has embarked on a program to evaluate VD systems in a range of shipboard spaces. Researchers have conducted an initial evaluation in a 10 x 10 x 3 m high compartment with an open area and a congested, cabinet-filled area. This evaluation has shown that the VD systems can generally outperform both ionization and photoelectric detectors in their ability to detect a larger range of smoldering sources and to initiated an alarm more rapidly. For flaming fires, the VD systems (using only smoke detection algorithms) performed similarly to photoelectric detectors and under performed ionization detectors.

Video-based fire detection provides a practical means to protect outdoor equipment and structures that are open to the weather and cannot be effectively protected by current fire detection systems. Examples of applications include tank farms and train stations (see Fig. 4). The VD systems can allow detection of the whole camera image, as shown in Figures 3 and 4. It can also provide detection for user-defined zones within the image. This feature allows the system to target areas of concern, and to disregard image areas of potential nuisance sources. In addition, alarms can be set up to require cross-zone detection between zones within a camera image or between zones from different cameras.

Video-based fire detection systems can cover a large area and do not require the smoke to reach any specific point location

Providing fire protection for historic buildings poses many challenges to not disturb the historic features of the structure. Running wire and mounting devices of typical fire alarm systems is just not possible in many of these applications for both aesthetic and practical installation reasons. Many museums and historic buildings already have surveillance cameras installed, which makes the use of video-based detection attractive. In addition, since a video camera can cover larger areas than a beam or spot detector, the use of a VD system can significantly reduce the installation requirements for wiring and devices.

Another advantage of video-based detection systems is the ability to have live video immediately available upon detecting a pre-alarm or an alarm condition. Personnel can set a value for the pre-alarm level that allows them to easily view the space and determine whether the alarm has come from a false signal or an incipient fire. Having video of the fire location will allow responding personnel to have more knowledge and, thus, arrive at the scene more adequately prepared for the event. The video also provides continuous monitoring of the event. A standard fire alarm system does not provide any means to assess the state of the fire after the fire is detected.

The VD systems log all alarm conditions in a history file with a digi-

The systems can also be designed to provide digital snapshots associated with other events, such as pre-alarms or trouble conditions

Video-based fire detection in a road tunnel. *(Pic courtesy of Fire Sentry Corp.)*

tal photograph of each image that caused the alarm. The systems can also be designed to provide digital snapshots associated with other events, such as pre-alarms or trouble conditions. These images provide a means to diagnose potential problems. In the event that a nuisance alarm does occur, the history file with the video photo can provide the basis to make a system adjustment. Having an image offers a great advantage over standard fire alarm logs that only report a text message and time stamp. In many cases, the source of a trouble or nuisance alarm with a standard fire alarm system cannot be easily identified.

In an age of ever-increasing use of video for surveillance and security identification, such as facial recognition, the potential to utilize the video images for multiple purposes is a logical step. The development of video-based fire detection technology offers such a step. But more importantly, it provides a significant step forward in fire protection systems. This detection technology provides advantages in many applications that cannot be effectively covered by typical fire alarm systems. More manufacturers continue to improve and develop video-based fire detection technology. As the technology becomes more widely accepted and recognized in the codes and standards, fire protection engineers should consider the potential benefits of using video-based fire detection in their fire protection system designs.

New Contact Information

The International Water Mist Association has moved into another office building and therefore has a new address and telephone number. The IWMA office can be reached as follows:

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The internet domain remains the same (www.iwma.net)

2nd Announcement

3rd International Water Mist Conference

Topics that will be discussed at the Barcelona conference from 9–11 April, 2003, are as follows:

System Applications

Solutions for mass transportation systems, traffic tunnels, office buildings, hotels, archives and galleries, storage and sales areas, health care facilities, industrial processes and other new applications where water mist has been found to be a cost effective replacement for halon and sprinkler systems.

Regulations, Standards and Codes

Assessment of currently available regulations, planned standards and changes to standards, including gaps in regulations and further needs.

Research & Testing

Small and large scale testing, suppression technologies, spray characteristics, advantages/disadvantages of water mist systems, comparison to other fire-fighting methods, CFD Modeling and research needs in the future.

Environmental and Health/Safety Issues

Overview of water mist from the standpoint of health authorities. Discussions on the importance of the use of water mist as a tool in reducing the ozone layer problems posed by halons.

Mobile water mist systems which enable fire fighters to extinguish fires very efficiently.
Photo courtesy: Callies Fire Safety

Parties who are interested in attending this meeting should browse the association's web page for details. Attendees who would like to present a paper may submit in abstract of the paper no later than February 2003.

Furthermore, a workshop on water mist fire suppression technology is offered which will take place from February 25–27, 2003, in Mobile, USA.

Educational Seminars in 2003

Besides the seminar on water mist fire suppression technology on May 16 in Dallas, USA, which will be held in conjunction with the forthcoming NFPA congress, another seminar will be offered in Germany next spring. The seminar is scheduled for 13 and 14 March, 2003. Interested persons can contact the IWMA office in order to receive a program for the educational sessions on both days. Due to the high demand, another seminar will be organized for United Kingdom in Autumn, 2003. The exact date will be announced on the next IWMA news page.

European Guideline for Water Mist

A European working group is currently preparing a design and installation guideline for water mist systems. The group started its work in 1998 and has met for the last time on October 16 and 17 in Cologne, Germany. The results of this last meeting, to be summarized in Draft number 10, will be submitted to the European Committee and will be further distributed to the national committees for assessment. The comments made by the national committees are going to be discussed in future meeting and will influence the final wording of the guideline. However, great progress has been done so far and the design and installation guideline for water mist systems is not too far away.

New Contact

International Water Mist Association

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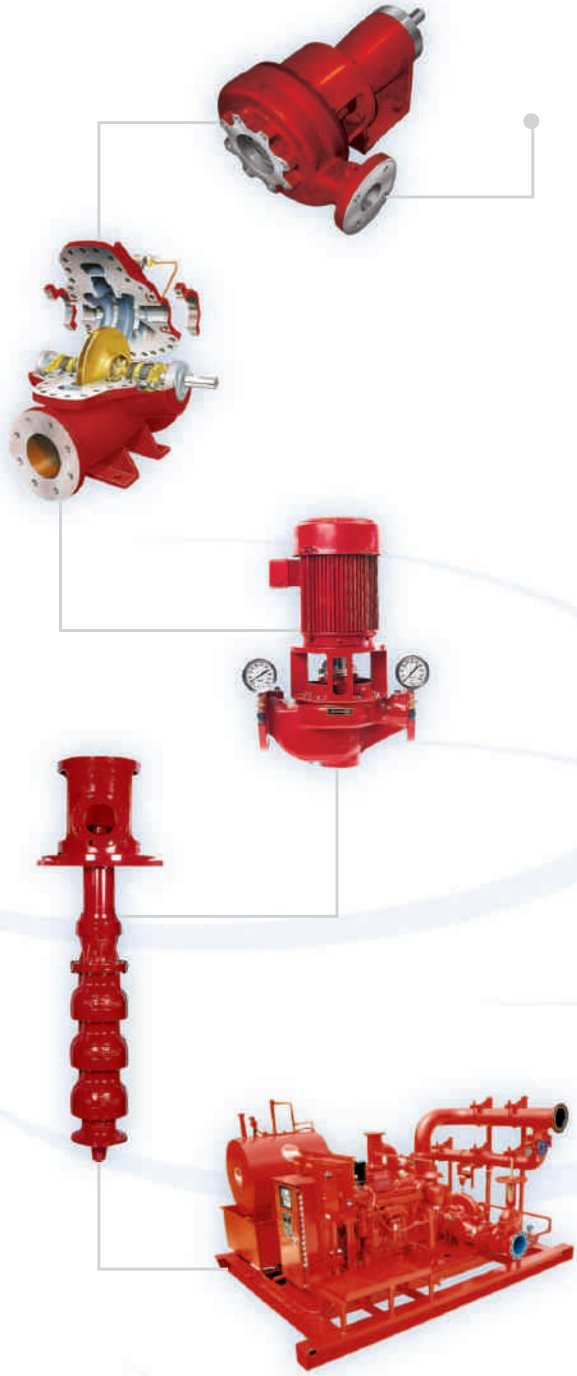
Fax: 690 26
www.iwma.net, contact@iwma.net



Patterson Fire Pumps What the Industry Relies on These Days

World-Class Quality Assurance

Patterson Pump Company has Six Sigma and ISO 9000 certification, which attest to the world-class quality and dependability of our pumps. You are assured of an optimized level of performance. Our pump designing know-how, efficient production capability and careful attention to testing details ensure that each Patterson fire pump will perform its intended function efficiently, economically, reliably and durably.

Comprehensive Line Of Available Fire Pumps

Patterson continues to be the industry leader in prompt delivery of all standard model fire pumps worldwide. Four types are offered, for anything from small commercial establishments, to mid-range fire service, to large installations with existing wet pits. Choose from horizontal split case, vertical turbine, vertical-in-line or end suction models, or choose our highly efficient Pre-Pac® prepackaged fire system.

World-Class Training

Patterson reliability is enhanced by coordinated training in proper operation and maintenance of fire pumps at our state-of-the-art training facility in Toccoa. This is an essential part of providing full service to contractor, industrial, commercial and governmental customers.

Personalized Service

Whether a complete rebuild, a single O.E.M. part requirement, or simply a question, Patterson stands ready to give personal field and factory service, as required, to maintain our reputation for providing the best service in the industry.

Call, fax or write us today. Or, reach us on the Internet.

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Coatings for Indust

By David Sugden

THE PETROCHEMICAL INDUSTRY has a vital role in modern industrialised countries and provides vital materials without which our daily lives and business cannot continue. The processes that refine and produce the products are often by their nature hazardous and the materials, particularly the intermediates can be highly inflammable and toxic when burned. The resulting fire effluent, whether in smoke, gaseous, solid or liquid form can pollute and even cause fatal effects and long term damage. When we are concerned with these ecological affects the cost to the community as a whole of a fire can be almost incalculable. The losses that may be sustained by the owners of such plants in a serious fire can threaten the very existence of the company.

In view of the risks the fire safety of industrial plants of all types is an essential consideration. It is not just petrochemical plants that have the risk, many industrial production facilities utilise materials and undertake processes that would cause immense problems in case of fire and so must be protected as well as possible. What then is the process that must be followed when considering such installations and the safety of both the plant and the community?

THE CONSIDERATION PROCESS

The first step, as with all such situations is to define the risks that exist within the process and examine the fire load. Building regulations where they apply will consider cellulosic fire to be the main risk but in an industrial plant the risk may be hydrocarbon based and the difference in fire performance is substantial as was seen in the Twin Towers disaster. The volume of potential fuel for a fire will also be considered when determining the duration requirements.

Evidence shows that many of the fires that occur in industrial plants start with an explosion and very basic rules are applied to petrochemical plants to minimize such risks in the first place. We need to consider however what explosion risk remains and allow for that in the fire strategy. This must also consider escape, fire fighting, public safety and a myriad of other elements so that a final strategy can be defined.

Once this has been done the real process of designing the fire protection systems can begin and the equipment to be protected will be defined. This can include:

- Structural frames
- Process equipment
- Storage vessels
- Services
- Buildings
- Transport equipment

The fire load and escape and reaction considerations will determine the time periods and at this stage in the process the regulatory considerations will come into effect. In the UK buildings will in general be protected according the Building Regulations but all other areas may be subject to Health and Safety Executive rulings and in the case of offshore plants these may be based on the Solas regulations. The final input may well be from the insurers as public liability and business continuity considerations can, in the present conditions cause premiums to be extremely high and are causing many existing companies to reconsider their fire strategies.

The resulting mitigation and protection requirements present a major role to the Fire Protection Industry and all concerned have a range of products specifically designed to provide help and protection for plant operators.

Evidence shows that many of the fires that occur in industrial plants start with an explosion and very basic rules are applied to petrochemical plants to minimize such risks in the first place.

WHAT PROTECTION CAN BE PROVIDED?

The overall Fire Strategy will have many elements and these will include comprehensive systems for detection, alarm and initial reaction from the “Active” fire protection industry. In this article we are considering the “Passive” elements of the strategy as in the overall picture the various systems work together to protect the plant and public alike.

Having defined the fire type as either cellulosic or hydrocarbon the selection of materials can follow. If the risk of explosion is high then many materials in this market have test data on their resistance to blast and also have information on hydrocarbon “Jet Fire” capability. Structural steel and vessels may be protected by either intumescent coatings or cementitious materials and Leighs Paints report that recent projects have required test data for blasts of up to 4.0 bar overpressures that have been met by their Firetex M 90 epoxy intumescent product.

The risk of Jet Fire is a serious consideration if product or fuel lines are ruptured in an incident. The Spadeadam test facility of Advantica Technologies has tested many materials for their ability to withstand Jet Fire for periods of up to two hours and test methods for this condition are con-

rial Fire Protection

Plant operators and designers should seek test information for blast and jet fire resistance as well as hydrocarbon fire test data for any product selected.

tained in report OTI 95 634 published by the International Jet Fire Test Working Group through the HSE. The ability of PFP materials to work under the extreme conditions that may exist in the early moments of an incident is a vital consideration in limiting the damage sustained. Plant operators and designers should seek test information for blast and jet fire resistance as well as hydrocarbon fire test data for any product selected.

Epoxy intumescents, cementitious and some board systems have the capability to protect steel for two hours or more in hydrocarbon fire and offer protection at varying levels of initial investment. Where offshore structures and complex plants are to be protected the long life capability of the epoxy intumescents can be used alongside compatible anti corrosive paint specifications that use common primers and decorative top coats for simplicity of specification.

STORAGE VESSEL PROTECTION

Storage vessels, particularly LPG tanks and similar units containing highly explosive materials can also be protected by these materials and again some specific test evidence should be sought from manufacturers offering systems. One test that is particularly relevant is conducted under German Federal Regulation TRB801, appendix to NR 25 at the BAM test facility in Berlin on LPG storage tanks. Under this 90 minute external test the internal temperature rise within the vessel must be restricted to less than 300°C whilst a fire runs for this period at over 900°C. As the tank is loaded to about 75% capacity with gas during the test the pressure safety valves must operate during the test to vent pressure and any failure can be spectacular. Although the time/temperature curve for this test is not so severe as the hydrocarbon test material manufacturers may have assessments to hydrocarbon temperatures.

Vessels may also require insulation for production reasons and combination systems of heat insulation and fire protection are available. These may take the form of mineral fibre or some other insulation overcoated with PFP. An alternative is the use of specialist materials such as a syntactic epoxy insulant that would be compatible with epoxy intumescent. This latter combination of insulant and PFP enables high performance epoxy fire protection to be applied to vessels operating at higher temperatures. Systems of this type can be designed to allow removal of sections for maintenance purposes and they can also be cast for use on pipe work, pumps and other complex items that would be difficult to treat with other materials.

CABLE PROTECTION

Fire risk from electrical and other cable runs, switchgear etcetera is another concern and coatings and protection systems for these areas are available from several sources. The use of specialist cable trays and boxing using fire resistant board systems is common but care must be taken that adequate cable seals are used as these pass through walls, bulkheads and decks.

The range of systems is very wide but testing of them is rather less clear than for the structural materials. BS 476 does not provide a test method for cable seals so that manufacturers offer materials tested to ad-hoc methods but using the cellulosic or hydrocarbon furnace test curves described in BS 476 part 29. An alternative test method to use, especially in high hazard areas is the IMO test to resolution A754 under the Solas regulations. Although designed for marine use and stipulated for offshore plants, materials carrying certification from this test will offer the user excellent cable penetration sealing systems in industrial conditions.

Compartmentation of industrial plants is essential if they contain areas of mixed hazard and fire walls may have to be designed to the same blast standards as are mentioned earlier for the structural and vessel protection materials. Offshore experience in these areas is extensive and is used by material suppliers to design fire barriers and safe havens in complex plants. Hydrocarbon testing of fire doors and shutters is particularly well established and these have many industrial uses. The quality of installation of mechanical doors for use in fire is of the greatest importance and usually undertaken by the manufacturers themselves.

A typical specification for steel vessel fire protection using epoxy syntactic foam as insulation would be:

Blast clean to SA 2.5 as defined in BS 7079: part A1, 1989
Apply Epigrip M251 Phenolic Epoxy primer to 75 microns
Apply Firetex M 89 Epoxy Thermal Barrier Coating to 20mm (say)
Apply Firetex M 90 Epoxy Intumescent to required dft (according to fire protection requirements)
Decorative sealer coats may then be applied according to requirements

This would allow the vessel to operate at temperatures up to 150°C under normal conditions and provide fire protection should this be required.

Whatever the requirement the quality of workmanship needs to be of the highest calibre in industrial plants as the result of fire can have far reaching repercussions. Continuous risk assessment must be undertaken and changes to plant operations fully considered for their impact on the fire precautions.

AMERICAN PACIFIC ANNOUNCES LANDMARK FAA APPROVAL

American Pacific Corporation (NASDAQ: APFC) announced today the landmark Federal Aviation Administration ("FAA") approval of a Halotron I clean agent portable fire extinguisher to replace severe ozone depleting halon 1211 on civilian commercial aircraft. The Halotron I extinguisher, manufactured by Amerex Corporation of Trussville, Alabama, has a net weight of 5.5 lbs and was the first to successfully complete all required FAA and Underwriters Laboratories, Inc. ("UL") tests. Each extinguisher has the following label: "FAA Approved. Meets the Minimum Performance Standards for Handheld Extinguishers as defined in Report DOT/FAA/AR-01/37."The standard for approval was the culmination of a nine-year process started in October 1993, at the FAA Technical Center at Atlantic City, NJ.

This new Amerex Halotron I extinguisher provides an environmentally acceptable substitution for halon 1211, that is extremely low in ozone depletion effect, as well as global warming effect. It provides, the environmentally balanced alternative that is needed for the airline industry. Halotron I is, the most widely used halon 1211 replacement and is carried by four of the five major US fire extinguisher manufacturers, including Amerex, Badger, Buckeye, and Kidde.

According to the Company's best information, there are approximately 6,500 commercial passenger carrying aircraft in the US that are the size of a Boeing 707 or larger that carry an average of five halon 1211 extinguishers. There is approximately the same amount in the rest of the developed world. As a result of the US EPA ban on non-essential discharges of halon 1211 (except on "real fires"), the airlines have been unable to conduct live fire training with the halon 1211 extinguishers now employed on these aircraft for more than seven years. Some airlines have chosen to use alternate agents for simulation, such as water.

The availability of this new Amerex Halotron I extinguisher gives airlines the dual advantage of transitioning to an environmentally acceptable product, as well as a product that can be used for full training programs, once again.

American Pacific Corporation is a specialty chemical company that produces products used primarily in space flight and defense systems, automotive airbag safety systems and fire extinguishment systems. The Company also designs and manufactures environmental protection products and is involved in real estate development.

Halotron® is a registered trademark pursuant to applicable intellectual property laws and is the property of American Pacific Corporation or its subsidiaries.

For more information, please contact:
American Pacific Corporation
Tel: +1 702 735-2200
Website: www.halotron.com

RADICALLY NEW FIRE SUPPRESSION TECHNOLOGY WILL MEAN RETHINKING PROCEDURES

FireAde 2000 is first product to take on entire fire tetrahedron

A new fire suppression technology is now available in from **Fire Service Plus**, a member company of the Safety Showers group. This new technology is so radically different from anything that has gone before that it will lead to the rethinking of many time hallowed procedures used by Airport fire teams. Based on a unique system of hydrocarbon denaturing and management it has been 20 years in developing and testing in the USA.

Because of this the product, known as FireAde 2000, is not just another fire fighting medium. Unlike water, traditional foams, or the plethora of powders, gels and gases used in fire fighting, its properties are such that it can effectively attack the entire fire tetrahedron. This means, at a stroke, reducing heat, eliminating oxygen, removing fuel and interrupting the free radical chain reaction, which keeps fires going.

It is applied by introduction into the water stream via any kind of liquid concentrate proportioning device. If premixed at a 0.25% ratio or higher it provides tremendous extinguishing capabilities. Any quality of water can be used with FireAde 2000, which works by reducing water surface tension from, typically, 72-dynes/cm^2 to 23-dynes/cm^2. Put simply that means that mixing FireAde 2000 with water enables the latter to work six times harder or, put another way, it becomes six times wetter. Water with FireAde 2000 added will cover more area and penetrate deeper into the surface texture of the burning material. In the US this has resulted in record knock down times as well as reduced crew numbers at an incident.

At the same time where flammable liquids are involved FireAde 2000 acts as an emulsifier. That is to say product, water and flammable liquid mix and encapsulate hydrocarbon molecules, thus preventing ignition or re-ignition. It's this feature that makes the product an excellent medium for cutting a non-reignitible fire path through burning fuel to rescue casualties or property. It also makes it ideal for dealing with Hazmat incidents, where FireAde 2000's use seriously reduces the risk associated with hydrocarbon spills.

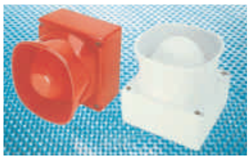
Also because FireAde 2000 makes water six times wetter it acts as a dramatically effective cooling medium, enabling previously hot debris, including metal, to be cleared away by hand almost immediately after a fire has been extinguished.

Although not formulated as a foaming agent FireAde 2000 will produce and maintain a foam blanket covering it and depriving it of oxygen. The encapsulating qualities of FireAde 2000 work just as well on smoke as liquids. On its application dense and toxic black smoke rapidly changes to white non-toxic smoke. This is because the product interrupts the chain reaction of free radicals thus preventing them from coalescing and forming soot and smoke. This in turn means improved safety and visibility for fire fighters.

In addition to its frontline qualities FireAde 2000 also addresses logistical and environmental concerns. Easy to store and transport it has unlimited shelf life, even after it has been mixed with water. It is also non-hazardous, non-toxic, non-corrosive and biodegradable. It is effective for use on fire categories A, B and D and European categories C, D and F.

For further information, please contact:
Fire Service Plus Limited
Tel: +44(0)151 643 8888
Website: www.fireserviceplus.com

FULLEON LAUNCH NEW SOUNDERS



Fulleon have launched two new additions to the popular Symphoni sounder range.

Certain applications require sounders to be located externally. The Symphoni IP and Symphoni IP HO (High Output) are being introduced to cope with the high level weather resistance demanded in such exposed situations or those areas subject to more severe environmental conditions.

A new robust base design has been developed to endow the Symphoni range with a weather resistance of IP66. The square format of the base, which increases the sounders' height by 10mm, allows cable entry in both top and bottom faces, providing flexibility of cabling formats and simplifying installation.

All of the features which ensure the popularity of the standard Symphoni and Symphoni High Output sounders have been retained and carried over to the IP versions.The Symphoni IP maintains its ultra low current operation producing 100dB(A) from just 5mA. Provisions to allow the fitting of sounder control boards for addressable systems are incorporated in a similar manner to the standard units.

The Symphoni High Output produces 120dB(A) and has a choice of 32 tones, making it ideally suited to the coverage of larger open spaces. Even with the small increase in height it is still one of the most compact sounders capable of producing such high audible outputs.

In addition to sounders, Fulleon also manufacture a wide range of other products for the fire industry including beacons, combined sounder/beacons, bells, callpoints and door release units.

For more information, please contact:
Fulleon Ltd
Tel: +44(0)1633 628 500
Website: www.fulleon.co.uk

KILSEN NEW PANELS TO MEET ANY REQUIREMENT

Kilsen, the Spanish manufacturer based in Barcelona, is expanding it's range of Fire Alarm control panels with the introduction of the new KSA 701/2 one/two loop analogue/addressable, the new NK-700 1-16 zone conventional and the new 1-2 zone gas/extinguishing panels.

This places Kilsen among the leading manufacturers in the European fire detection business.

The KSA 701 will complete the KSA 700 range (see chart) bridging the gap between analogue/addressable and larger conventional systems. It has a capability of 100 addresses per loop, RS-232 and optional RS-485 communication ports from only one compact motherboard. This panel will be extremely useful for small installations where advanced technology in fire detection is major requirement.

The KSA 702 and KSA 705 will remain the standard product for large installation projects that require greater flexibility using options like built-in printer, GPS communication or networking in a peer to peer configuration.

The new NK-700 range of conventional control panels have been designed and manufactured to comply with European standard EN-54 and offer a step forward in conventional panel design and operation. Two of

the models in this range are designed for the control of 1 or 2 extinguishing zones, providing all the necessary inputs and outputs for that purpose.

Finally, the new NKB range will offer the best price/quality ratio in the fire detection market. These limited zone control panels will be suitable for small conventional installations where price sensitivity is important.

The performance of all these new panels is enhanced with more than 10 different operational modules that fulfil every possible requirement for the complete protection of any premises.

With this new product range structure, Kilsen is offering its customers a range of solutions for every requirement in fire detection.

Model/loops	Addresses	RS-232	RS-485	Built-in Printer
KSA701/1	100	Included	Optional	-
KSA701/2	200	Included	Optional	-
KSA702/1	250	Optional	Optional	Optional
KSA702/2	500	Optional	Optional	Optional
KSA705/3	750	Optional	Optional	Optional
KSA705/4	1000	Optional	Optional	Optional
KSA705/5	1250	Optional	Optional	Optional

For more information, please contact:
Kilsen
Tel: +34 93 480 9070
Website: www.kilsen.es

NEW WARNING SYSTEM IS PERFECT SAFETY NET

New software from **Klaxon Signals** is set to revolutionise emergency warning systems in offices and factories; wherever staff have access to PCs. Safetynet enables orderly evacuations by putting tailored instructions and exit maps in front of each PC user exactly when they are needed, overriding whatever is currently displayed on the screen.

Safetynet is designed to complement audible warning systems and can be configured to warn of fire, security and other hazards. The system can also be used to call individuals to help, such as fire or evacuation wardens.

If staff need to complete something, they can quickly clear the alert and continue. The program can be configured to return at fixed intervals or shortening time paths.

Safetynet is a permanently running program that is installed on a central administrator PC, and a small application on all client PCs on the network. This allows each user to be identified as a member of a group (first aiders, evacuation monitors) and confirms their location (building, floor).

Today's mobile workforce makes training all staff in evacuation procedures inconvenient and costly. Safetynet effectively mitigates this problem for organisations using significant numbers of desktop computers.

Safetynet can be controlled from one PC, or linked to audible warning systems. At one mouse click from an authorised user, or automatically in response to an alarm, the software can be used to instigate full (fire, flood or other immediate emergency), partial (where one area needs to be isolated) or controlled evacuations, where several floors may need to be evacuated in sequence.

Changes to evacuation procedures can be accommodated: in the event of an unforeseen emergency, Safetynet's ad-hoc screen allows authorised users to type in a couple of sentences to cover any eventuality. No unauthorised user can send alerts, although anyone can summon first-aiders, fire officers or security staff.

The system incorporates many other features, including the ability to send SMS messages to safety personnel for out-of-hours or out-of-office notification of an emergency. Additionally, non-emergency information may be communicated across a network, for example a note sent to inform users of planned interruption for back-up. Adoption of a colour-coded system such as yellow for information and red for emergency alert will allow staff to immediately see the difference between the two types of message.

A free CD-ROM containing a trial version of Safetynet, as well as further information about the product, is available directly from Klaxon.

For more information, please contact:
Klaxon Signals Inc
Tel +44 (0)161 287 5511
Website: www.klaxonsignals.com

MORLEY-IAS FIRE SYSTEM PROTECTS VULNERABLE PATIENTS AT BETHLEM HOSPITAL

Bethlem Hospital is a secure hospital for mentally disturbed patients set in 37 separate buildings at Beckenham, Kent. Founded in 1247, many people, including some very well known artists such as Richard Dadd, Vasilev Nijinsky and Louis Wain, have played a part in its history. The most famous

Bethlem Hospital, known as Bedlam was notorious for the exhibition of lunatics for public amusement and was used by Hogarth as the setting for the final panel of his morality tale series "The Rake's Progress". The current buildings date from 1930 and the fire protection systems at the hospital have been installed piecemeal over the years.

The decision was taken to install a new single, campus-wide networked system using the **Morley-IAS ZXe** analogue addressable family. Its open protocol capability, networking capabilities, expandability and user friendliness were key attributes, as was the wide choice of fire companies qualified by Morley to carry out servicing and maintenance. The new system consists of 39 ZXe networked control panels controlling more than 5000 Apollo Discovery smoke and thermal detectors, configured as a report and control system with three master controllers and 38 repeater panels located throughout the complex. The system protects all secure and non-secure areas and is programmed to take full advantage of the ZXe panel's advanced features such as pre-alarm notification, staged evacuation and day/night sensitivity settings. In the secure wards, special key-operated manual actuators interact with the security system.

Cover has not been compromised during the installation. If a conventional system is being replaced, the new system's detectors are installed in parallel with the old ones and soak tested for a month with the old system still operational; the old system is then removed. Some buildings were already protected by analogue addressable systems; here, the new panel temporarily takes over the control of the old detectors by installing the appropriate interface board. The new Apollo detectors are then installed and the temporary card swapped out for the Apollo version; the loop wiring is reused wherever possible, reducing the overall cost. The installation is due to be fully completed in early 2003.

For further information, please contact:
Morley-IAS
Tel: + 44 (0)1444 235556
Website: www.morley-ias.co.uk

VESDA LASERCOMPACT IS NOW BIGGER AND BETTER THAN EVER

Vision Fire & Security's VESDA LaserCOMPACT, the highly successful aspirating smoke detection solution, has just become an even more widely applicable and more cost-effective solution. It now has extended aspirating – at no extra cost whatsoever.

Area coverage has now increased by as much as 60 per cent – from 500 square metres to 800 square metres – enabling increased detection over a wider area. The extended pipe coverage is now a standard feature and is fully approved by LPCB and VdS.

"The product has been enhanced in response to customer demand. More and more warehousing, high-bay storage facilities and cold stores are benefiting from VESDA Aspirating Systems. In response we have decided to increase the capability of LaserCOMPACT to make the product more flexible and applicable to such installations," comments Peter Mundy, Technical Manager.

LaserCOMPACT's increased detection over a wider area makes the product now ideal for environments such as large warehouses that require coverage of individual storage racks, or small computer rooms requiring up to 40 sampling points.

All the key benefits of LaserCOMPACT remain, and there has been no change to the PC software for configuration and maintenance. The product is still available in two versions: one that interfaces via relays only, VLC-500 (RO), or via the relays and VESDAnet, VLC-505 (VN).

LaserCOMPACT, launched in 1999, has been specifically designed to provide the best and most cost-effective protection of small areas, without compromising the highly acclaimed VESDA early warning smoke detection (using the patented High Sensitivity VESDA laser detector).

Typical applications of LaserCOMPACT include areas where: there are high airflows; mission critical equipment is installed; suppression might be installed but should be a last resort; early detection is needed within a process cell or control cabinet; nuisance alarms need to be identified and dealt with before a full alarm is raised; or localised early detection is required.

The VESDA detection technology incorporates a unique clean air wash to protect the critical optical surfaces from contamination. As such, it is able to maintain its sensitivity without resorting to drift compensation and adaptive algorithms used in inferior products.

LaserCOMPACT's latest coverage upgrade is one example of VESDA's ongoing goal to provide advanced, first-rate fire detection solutions to an even wider number of applications.

For more information, please contact:
Vision Fire & Security
Tel: +44(0)1442 242 330
Website: www.vesda.com

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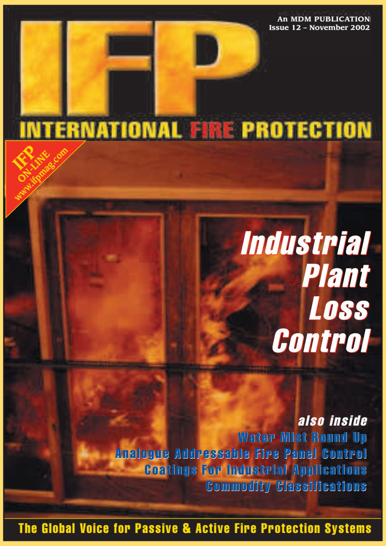
INTERNATIONAL FIRE PROTECTION

GET YOUR SUBSCRIPTION NOW!!!



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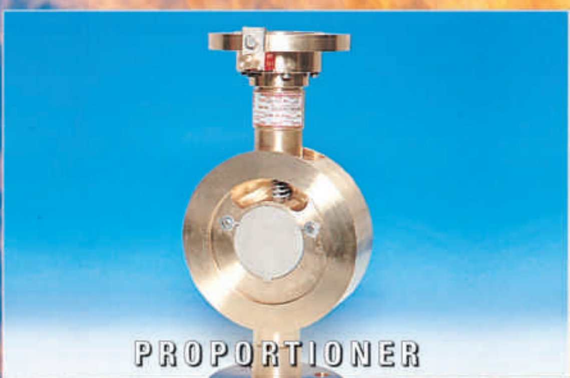
ADVERTISERS' INDEX

The Patended and unique FJM-Monitor is a powerful unit with excellent throw characteristics. The Stainless Steel construction means low weight, small overall dimensions and eliminated corrosion problems. Available in a wide range, as manual, mobile or remotely operated.

When it comes to foam fire fighting systems, we've got it covered

The new generation "inside air" foam and water-based extinguishing system for enclosed spaces. The efficient, cost effective and environmentally friendly alternative that is easy to install.

Foam is the most reliable and only environmentally friendly alternative when it comes to fire protection of storage tanks for flammable liquids. The tank protection equipment are made of high grade materials and complies with NFPA. Used by most major oil companies.



Accurate proportioning of the foam concentrate gives maximum performance of the foam system, or for adding foam to a sprinkler system for greater performance. Maintenance-free units are made of non-corrosive materials.

Svenska Skum has developed and manufactured fire fighting equipment since 1933. From a unique component to a large installation providing fire protection to an oil harbour, a refinery an aircraft hanger or a ship.
A continuous focus on research and development has brought Svenska Skum to the forefront in the design of new fire fighting technology.
The unique products that have been developed over the years and that have been introduced to a wide range of markets has made Svenska Skum a symbol of innovation and quality.

Anything else is simply wet.

SKUM

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Allan Associates Norway

Start thinking about replacing your Halon system now, while you still have time.

Regulation EC No 2037/2000 on substances that deplete the ozone layer. Article 4. Paragraph 4 (v) Fire protection systems containing halon shall be decommissioned before 31 December 2003.

(a small number of exceptions are listed in Annex VII in the regulations).

Now is the time to decide which system you are going to install and when you are going to install it.

Why Now?

- Allow enough time for a thorough evaluation
- Take control and make the conversion on your time line, not someone else's
- Eliminate the last minute rush when demand for technical resources will be overloaded and conversion costs at a premium

Why FM-200®?

- Fastest fire suppression system on the market
- Safe for people and sensitive equipment
- Environmentally safe
- Simple to install and occupies up to 7 times less space than an inert gas system
- More than 100 thousand customer applications in over 70 countries makes FM-200® the most widely accepted clean agent in the world

To find out more about why an FM-200 system is ideal for Halon replacement, call **+44 (0) 161 875 3058** or visit **www.FM-200.com**.

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FM-200®

The World's Most Trusted Choice In Clean Agent Fire Suppression.